Centre of Marine Environmental Measurements, FIO, SOA

Testing Report

FIO（Ins）[2012] NO.: C0402

Prepared for: Shanghai Cyeco Environmental Technology Co.,Ltd

Test Samples: Environmental parameters, Organisms (>10um),Microbes

Test Organization: Centre of Marine Environmental Measurements, First Institute of Oceanography, SOA

Approval: Yin Zuefen

Issue date: Feb. 15, 2012

Address: No. 6 Xianxialing road, Qingdao, China

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Contact: Li lang **Email**: lilang@fio.org.cn

Address: No.6，Xianxialing Road， Qingdao Hi-tech Industrial

Tel: 0532-88967640 **Post**: 266061

Fax: 0532-88962430

Centre of Marine Environmental Measurements, FIO, SOA

Report of the Land-Based Testing of Cyeco™ -BWMS

FIO (Ins) [2012] NO.: C0402

Prepared for	**Name**: Shanghai Cyeco Environmental Technology Co. Ltd	**Contact**: Ji Ming
	Address : No.5C, Unit 12, Lane 1097, Pudong Avenue, Shanghai	**Tel**: 021-58852405
	Entrust date: July-September, 2011	**Testing date**: July, 2011 - November, 2011
Samples	Name : temperature、salinity、NTU、pH、DO、TSS、POC、DOC、TRO、organisms (10-50um)、organisms(>50um)、microbes	**Number**: total 919, 360 for water quality; 120 for organisms (10-50μm); 120 for organisms (>50μm); 120 for microbes; 120 for Chl-a;12 for TRO; 43 for PAM,24 for MPN.
	Label : I-C-SP-…series number outside the bottles or Petri dish membrane	**Note**: "a"was added at the end of number for organisms (>50μm) samples, such as I-C1-SP1-B/a; "b"was added at the end of number for organisms (10-50μm) samples, such as I-C1-SP1-B/b; "c"was added at the end of number for microbes samples, such as I-C1-SP1-B/c; "d"was added at the end of number for water quality samples, such as I-C1-SP1-B/d; "e"was added at the end of number for Chl-a samples, such as I-C1-SP1-B/e;
	Received by/sampled by: Ping Liu **Sampling date**: 2011.7~2011.9	
	number of submitting list: 201202	

	program	parameter	standard	method	Equipment/Model	Testing person
Testing	Environ-mental parameters	T, S, pH, DO, NTU,TSS, POC,DOC TRO	GB/T12763.5 -2007 ; GB17378.4-2 007,	T and S equipment pH: Acidmeter Turbidity:spectroph-otomerric method, TSS:weight method POC and DOC: Combustion method	Multi-parameter water quality instrument; Analytical Balance Elementar analyser TOC-V_{CPH}Aanalyzer 722S Spectrophoto-meter	Xie Lingpeng Sun Xia
	Plankton	≥50 μm, 10~50 μm, Chl-*a*, Photosynth etic activity, MPN cultivation	GB/T12763.6 -2007	Neutral red staining, count with stereo -microscope FDA-PI staining, count with invert microscope fluorometer measure	LeicaL2 stereo-microscope NikonTE2000-U invert microscope, Turner fluorometer Phyto-PAM	Li Yan Liu Ping SUN Ping
	Microbes	bacteria, *Vibrio cholerae*, *E.coli* Intestinal *enterococci*	GB17378.4-2 007 ISO9308-1 :1 998 Iso7899-2 :20 00	Plate method, Membrane filter method		Zhang Jie

Result	Appendix 1～2:Results for chemical parameters of the Land-Based Testing of Cyeco™ -BWMS Appendix 3～4 Results for organisms (>50um) of the Land-Based Testing of Cyeco™ -BWMS Appendix 5～6 Results for organisms (10-50um) of the Land-Based Testing of Cyeco™-BWMS Appendix 7～8 Results for microbes of the Land-Based Testing of Cyeco™ -BWMS Appendix 9 Results for TRO of the Land-Based Testing of Cyeco™ -BWMS Appendix 10 Results for Chl-a of the Land-Based Testing of Cyeco™ -BWMS Appendix 11 Results for photosynthetic activity of the Land-Based Testing of Cyeco™ -BWMS Appendix12-13 Results of MPN cultivation of the Land-based Testing of Cyeco™-BWMS

Analyzed by	Li Yan	Checked by	Li Ruixiang	Approved by	Yin Zulfen
Date of compiling	2012.2.14	Date of checking	2012.2.14	Date of Approval	2012.2.14

CONCLUSIONS

The land-based testing of BWMS manufactured by Shanghai Cyeco Environmental Technology Co.,Ltd was conducted at Shidao Port of Shandong Province from July 2011 to September 2011. According to the testing results and the reference of G8 and D2 standard, the conclusion was made as follows:

1) During the test, the temperature of water samples varied from 22.2 to 25.9℃, the mean salinity was 32.6 PSU and 21.7 PSU for the two regimes respectively; what's more, the TSS concentration was 20.43 mg/L for high salinity regime and 55.47mg/L for low salinity regime; DOC concentration was 2.84mg/L（high salinity regime）and 6.65 mg/L（low salinity regime）; POC concentration was 1.63 mg/L（high salinity regime）and 5.41 mg/L（low salinity regime）, all met the requirements of G8。

2) Besides the *Oithona* sp. and *Brachionus* sp. which were added, other species of ≥50μ were local nature communities, mainly included: *Oithona* sp., *Paracalanus parvus*, *Acartia* sp., Nematoda, Protozoa and larvae of polychaetes, et al, which were well above the requirements of at least 5 species from at least 3 different phyla/divisions of G8. The density of this size fraction for influent water of control tank was 2.5×10^5 ind./m^3 and 7.29×10^5 ind./m^3 for the two regimes respectively, which met the requirements of G8. No viable organisms of this size fraction were observed in the treated water, which met the D-2 standard.

3) Two added phytoplankton（*Platymonas helgolandica* and *Isochrysis galbana*）became the dominant species of this size fration. What's more, most of the species in nature original water belonged to diatom, mainly included: *Skeletonema costatum*, *Chaetoceros* spp. and *Cylindrotheca closterium* et al, the number of species met the requirement of G8. The density of this size fraction for influent water of control tank was 1.19×10^3 cells/ ml and 1.27×10^3 cells/ ml for the two regimes respectively, viable organisms of this size fraction was only observed in one treated water sample during the high salinity regime, and the density of viable organisms was 0.005cell/ml, which met the requirements of G8 and D-2 standard. The survival organisms after treatment at low salinity regime was 0 cell/ml.

4) Heterotrophic bacteria were abundant in influent water before treated, the density of all the samples were above 10^6 CFU/100ml, which met the requirements of G8 well. Although there is no clearly definition for the number of heterotrophic bacteria after treatment, the number of heterotrophic bacteria after treatment for high and low salinity regime was 2.12×10^2 CFU/100 ml and 1.27×10^2 CFU/100 ml respectively. As to the Escherichia coli, the density of which in influent water of control tank was 3.78×10^2 CFU/100ml and 3.3×10^3 CFU/100ml for the two salinity regimes, while viable Escherichia coli was only observed in three samples of one cycle of treated tank at T0 during the high salinity regime test, and the mean density was 56.7 CFU/100ml, after the second treatment of 5 days later, no viable *Escherichia coli* colonies were incubated from the water samples of two regimes; for the *Vibrio cholerae* and Intestinal *enterococci*, no survival colonies were observed for all 30 treated water samples. In one word, all results of microbes met the D-2 standard and the requirement of G8 completely.

In summary, the treatment effects of the test system to all the size fractions of organisms met the requirement of D-2 standard and G8.

Compiled by	SUN Ping	Checked by	Li Ruixiang	Approved by	Yin Tuefen
Date of compiling	2012.2.14	Date of checking	2012.2.14	Date of Approval	2012.2.14

Cyeco^{TM}-BWMS

(Ballast Water Management System)

Type Approval

Land-based Testing Report

Test Organization: First Institute of Oceanography, SOA

Supervision: China Classification Society

Manufacturer: Shanghai Cyeco Environmental Technology Co., Ltd

Testing Site: Shidao Port, Weihai City, Shandong Province

February 2012

Content

1 Introduction

Ships transport 5-10 billion tons of ballast water annually all over the world (Endresen et al. 2004). The ballast water is loaded with particulate sediment and an enormous variety of (living) organisms, which ranges from juvenile stages, larvae and eggs of fish and larger zooplankton (Williams et al. 1988; Carlton & Geller 1993) to macroalgae, phytoplankton (Hallegraeff et al. 1997; Hamer et al. 2000), bacteria and viruses (Gollash et al. 1998).

In general these organisms belong to the natural ecosystem in and around the port of origin but they might not be occurring naturally in the coastal waters and port of destination at the end of a ship's voyage.

In hundreds of cases around the world, this has resulted in severe damage to the receiving ecosystem and to human health, because these non-native organisms developed into a plague. This often has a high impact on the ecosystem and can cause economic damage (Hoagland et al. 2002), as it results in a decrease of stocks of commercially valuable fish and shellfish species and occasionally outbreaks of diseases such as cholera (Ruiz et al. 2000; Drake et al. 2001). If action is not taken, the problem of invasive species will increase in an exponential manner for several reasons.

Ships are getting larger, faster and the amount of traffic across the oceans is expected to increase rapidly during the coming decades, and therefore also the chance of non-indigenous organisms to have large enough numbers for settling and expanding. The problem of invasive species is considered as one of the 4 major threats of the world's oceans next to land-based marine pollution, overexploitation of living marine resources, and physical alteration/destruction of habitats.

To minimize these risks for the future, the International Maritime Organization (IMO) of the United Nations has adopted the Ballast Water Convention in 2004 (Anonymous 2005). The Convention states that finally ALL ships (>50,000 in number) should install proper ballast water treatment (BWT) equipment on board between 2009 and 2016.

As a temporary and intermediate solution for the time being ship may reduce the risk of

invasive species by performing ballast water exchange during their voyage when passing deep water (>200 m depth and 200 M from the coast) (Zhang F.Z & M Dickrnan1999). Ballast water exchange faces many problems as to feasibility, safety and efficacy for a large part of ships' voyages the required depth and/or distance to shore requirements are never met; BW exchange can affect the ships construction stability and in rough seas exchange is not possible because of the risk to ship and crew.

Treatment of ballast water is therefore considered to be the best solution of reducing the risk of invasive species. During the recent years numerous solutions for treatment of ballast water have been mentioned and tested with the ultimate goal to reduce the amount of organisms in ballast water (Rigby & Taylor 2001). Recently a ballast water management system developed by Hyundai Group of Korea is firstly installed aboard a super crude ship. The company undertook the order from OSC company at 2008， which was the first time that installing a ballast water treatment equipment aboard a super crude ship.（http://twitter.com/yonhapcn）.

The ballast water treatment research in China is just at the experimental stage. To develop effective ballast water treatment system could play a great role in protecting Chinese even the whole world's ocean environment and reducing the risk of invasive species.

As a result, we measured the land-based test samples treated by Cyeco^{TM}-Ballast Water Management System at the behest of Cyeco Environmental Technology Co.,Ltd.

2 Sampling and analyzing methods

2.1 Sampling volume, time and method

Table 2.1 and 2.2 showed the sampling volume and time for various analysis respectively. Except for DO and TRO, samples for water quality testing (NTU、pH、TSS) were collected at discharge outlet directly with 2.5 L plastic buckets. The samples were taken to the field lab and well mixed, subsamples were then collected for water quality analysis or pre-treatments. 500 mL water sample for DOC and POC is collected into clean glass bottles which were soaked with diluted HCl and rinsed by deionized water. For DO,

samples were siphoned to brown bottles using a special gastight tubing, which was properly fitted to the sampling outlet of the ballast water simulating tanks. Collection of TRO water sample were used dissolved oxygen bottles of 60mL and the overflow water volume should be 3 – 4 times of bottle volume for avoiding the generation of bubbles.

Table 2.1 Sampling volume and number at different stage of test

parameter	Influent water at intake(D0)	Treated water at intake(D0)	Effluent water of treatment tank at discharge（D5)	Effluent water of control tank at discharge（D5)
DO	150m L×1×3	150m L×1×3	150m L×1×3	150m L×1×3
NTU、pH、TSS	2.5L×1 ×3	2.5L×1 ×3	2.5L×1 ×3	2.5L×1 ×3
DOC、POC	500mL×1 ×3	500mL×1 ×3	500mL×1 ×3	500mL×1 ×3
Organisms≥50 μm	20L×1 × 3	$1m^3$× 1× 3	$1m^3$ × 1 ×3	$1m^3$ × 1 ×3
Organisms 10～50 μm	1L × 1 × 3	10L × 1 × 3	10L×1 × 3	10L × 1 × 3
Water sample for MPN	/	/	1.5L×3 × 3(5^{th} run in high salinity regime, 3^{rd} run in low salinity regime)	1.5L× 1 × 3(5^{th} run in high salinity regime, 3^{rd} run in low salinity regime)
microbes	500m L× 1×3	500m L× 1×3	500m L× 1×3	500m L × 1× 3

※ ： total sample number：96

Samples for organisms (≥50 μm) were filtered through a net with diameter of 37 cm at opening and 1 meter length (Figure 2.1). Then the sample was transferred to a small bottle with a tag. Samples for the organisms between 10 ~ 50 μm were filtered through a net with 10 μm mesh (Figure 2.2). 10 L of sample water was filtered and then transferred to small bottles with a tag. The water samples for chl-*a*, PAM and MPN were collected directly at sampling point.

Figure 2.1 Filtering net（50 μm）

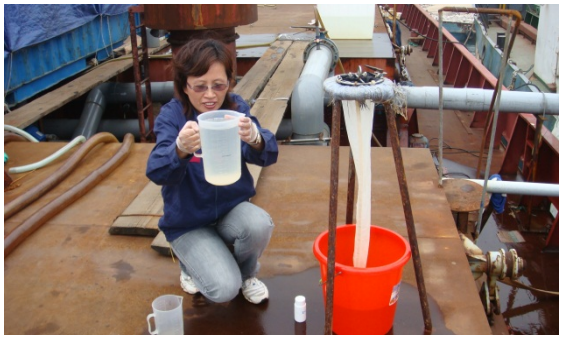


Figure 2.2 Filtering net （10-50 μm）

Table 2.2 sampling volume of different sampling category

Category	Stage	Sampling volume and number					Sampling point
		Water quality	≥ 50 μm	10~50μm	Chl-a,PAM, MPN	microbes	
Influent water at intake (D0)	Begin	2.5L	20L	1L	500mL	500mL	SP1
	Middle	2.5L	20L	1L	500mL	500mL	
	End	2.5L	20L	1L	500mL	500mL	
Treated water at intake (D0)	Begin	2.5L	$1M^3$	10L	500mL	500mL	SP2
	Middle	2.5L	$1M^3$	10L	500mL	500mL	
	End	2.5L	$1M^3$	10L	500mL	500mL	
Effluent water of treated tank at discharge(D5)	Begin	2.5L	$1M^3$	10L	1.5L	500mL	SP3
	Middle	2.5L	$1M^3$	10L	1.5L	500mL	
	End	2.5L	$1M^3$	10L	1.5L	500mL	
Effluent water of control tank at discharge (D5)	Begin	2.5L	$1M^3$	10L	1.5L	500mL	SP4
	Middle	2.5L	$1M^3$	10L	1.5L	500mL	
	End	2.5L	$1M^3$	10L	1.5L	500mL	

Samples for microbes were taken at the outlet directly in order to reduce the contamination of air. The sample bottles were treated under high temperature sterilization before sampling. Disposable gloves were worn and sterile operation was conducted as far as possible when sampling.

2.2 The treatment and storage of samples

2.2.1 The treatment and storage of samples for water quality analysis

During the test, there was a specified field lab about 40 m^2 at dock, in which sample analysis or pre-treatment would be conducted immediately after sampling. All the samples should be analyzed or pre-treated within 6 h after collection (if not, samples for water quality analysis have to be stored at freezer). Samples for TSS, POC and DOC analysis were taken back to Qingdao in a closed cooler with dry ice. The samples were stored immediately at -20 ºC freezer when the samples arrived at Qingdao.

2.2.2 The treatment and storage of samples for biological analysis

During the ballast stage, the organisms ≥50 μm were immediately fixed with formalin and organisms 10 μm~50 μm were fixed with Lugol's solution after the samples were collected. The cell counting and species identification were all performed in the field lab. and all the samples were brought back to the laboratory after the test to do the further checking. During the deballast stage, organisms ≥50 μm were dyed with neutral red dye immediately and complete the analysis in the field lab. Organisms 10 μm ~ 50 μm and the water samples collected at the discharge outlet were sealed and stored in the ice-frozen cabinet without any pretreatment and transported to the laboratory in Qingdao.

Samples for microbe analysis must be collected with sterile operation. Sample bottles were treated with high temperature sterilization. Inoculation in the field lab should be conducted immediately after sampling, then the samples would be cultivated in optimal conditions in incubator.

2.3 The methods and guidelines for analysis

2.3.1 Water quality：

1）Temperature：Using a multi-parameter water quality probe to measure the water temperature inside of the sample bottles quickly.

2）Salinity：Using a multi-parameter water quality probe to measure the water salinity directly.

3）pH: pH-metric method, subsamples were measured in-situ using a pH meter.

4) NTU: spectrophotometric method. Subsamples were measured in-situ using a spectrophotometer.

5）DO: iodometry method. Samples were siphoned using gastight tubing which was specially fitted to the sampling tubing that was used to sample the ballast simulating tanks. Special brown sample bottles were flushed at least three times their volume with water and were saved at dark containers until further analysis.

6）TSS：weight method. Pre-weighted glass fiber filters are used. Each filter was coded and stored in a clean Petri dish. The filtered volume was dependent on the particle load and concentration and type of organisms present in the water. The higher the total particle load in the sample, the smaller was the volume that could be filtered before the filter clogs. Practical volumes were between 100 and 1000 mL per sample, after filtration the filter was rinsed with fresh water (MiliQ) to remove sea salt. Filters were dried overnight at 60 °C and allowed to cool in a vacuum dryer before weighing. The total amount of suspended solids was calculated from the weight increase of the filter.

7） POC：high temperature combustion method，measured with an elemental analyzer. Water samples were filtered over pre-weighted glass fiber with 450°C combustion (the filtered volume was dependent on the particle load and concentration of organisms present in the water), the samples on filters were packed with an aluminium foil, coded, and then saved at -20°C, after the whole test, these samples would be taken back to our lab in QingDao and dried over 12h at 60 °C. The elemental analyzer （ElementarVarioELIII, produced by German）would be used to measure POC.

8）DOC：high temperature combustion method，measured with TOC-VcpH analyzer of Japan for analysis. Samples for DOC (15mL) were filtered through GF/C filters and sealed in pre-combusted glass ampoules after adding 50 µl of phosphoric acid (H_3PO_4), saved at -20°C and taken back to our lab in QingDao. Further measurement was conducted after samples were defrosted to room temperature. Standards were prepared with potassium hydrogen phthalate.

9）TRO：Principles: enough I- was added to samples before measured, with the acidic conditions (pH of 3.0- 4.0), the residual oxidants of samples would oxidize I- to I3- or I2 which were light brown and soluble. Then read the absorbance of spectrophotometer at the wavelength of 353 nm. At last, determine the TRO concentrations of the samples according to the standard curve, the unit of TRO concentration was equivalent concentration (µeq./L) or equal to Cl_2 concentration (mg/L as Cl_2).

Sample Collection: Collect sample water with dissolved oxygen bottles of 60mL, the overflow water volume should be 3 – 4 times of bottle volume (avoid the generation of

bubbles), 0.5 mL of buffer and 0.5 mL of KI solution were added and then closed the tap, reverse the bottle over several times to mix water samples uniformly, after which put the bottles into a plastic box with tap, took them back to the on-site lab for measurement after all the samples were collected

Procedure for determining：

（1） open the sample bottle, read the absorbance of spectrophotometer（ABSraw）at the wavelength of 353 nm within 10 minutes to 2 hours after adding the reacting solution.

（2） Blank

Add deionized water into dissolved oxygen bottles of 60mL, determine the absorbance of blank sample（ABSblank） as the normal procedure of determining. Generally, the ABSblank was below 0.002ABS.

（3） Turbidity background

0.5mL sodium hyposulfite was mixed with the remaining samples to eliminate the color of iodine, then determined again to get the absorbance(ABSturb）of background sample.

（4） Preparation of the standard curve

Prepare 100mL standard solution by diluting 1.0mL of potassium permanganate standard solution with deionized water, then prepare standard solutions in five gradient of concentration ranged from 0 to 100 μeq. / L with the former solution, similarly, diluted to 100 mL with deionized water.

The standard solutions were added to 60mL of dissolved oxygen bottles, with the procedure of (1) and (2), the slope (L/μeq.)of standard curve was obtained. （5）Data processing：

a. Calculate corrected absorbance values of samples by subtracting the absorbance of this water specific blank and turbidity background from the samples:

ABScorr＝ABSraw－ABSblank－ABSturb

b. Use the slope of the standard line and the corrected value determined from the calibration to determine the TRO concentrations of the samples.

$$C\ (\mu eq.\ /\ L) = ABScorr\ /\ S$$

Where:

C ： Equivalent concentration (μeq./L) of TRO in water samples

S ： slope of the standard curve。

Theoretically, the unit of TRO was μeq./L, however, conversion to unit of Cl_2 concentration was more common for easy analysis:

C (mg/L as Cl_2) = C (μeq./L) ✖ D8Dd8888

2.3.2 Biology

The majority of the large size fraction (>50 μm) consists of zooplankton, while the majority of the small size fraction (10-50 μm) consists of phytoplankton. Samples were filtered over a 50 and a 10 μm sieve respectively （volume of filtered water is shown on Table 2.1）. Then it was concentrated to 150 mL and poured into a small plastic bottles , wash the sieve twice and transfer the flushing fluid to the plastic bottles together, the samples for human pathogens analysis were taken in sterile sealed bottles.

1）Organisms > 50 μm

After sampling，identification and counting of viable organisms were taken with a stereo microscope before fixation. If the density of viable organisms was high, subsamples was taken with a quantified sampling tube or a sample splitter which can separate the sample into equal subsamples. Then one of the subsamples was analyzed.

In order to investigate and count the live and dead organism ≥ 50 μm, neutral red solution are added to the sample with an end concentration of 1:50,000. Staining time is 2 hours. The observation on organisms' activities was taken under microscope at 20-160x magnification. The results of identification and counting were recorded. When the counting of viable organisms was finished, formalin solution (the last concentration is 5%) was added to fix the samples. A further identification and counting of total amount of

organisms was conducted after the samples were taken back to Qingdao. Then number of individuals per cubic metre was calculated

The equation for abundance of organisms is as follows：

$$C_B = \frac{N_B}{V}$$

where：

C_B——density of zooplankton per volume，unit（ind./m^3）；

N_B——total number，unit（inds or cells）；

V——the volume filtered ，unit（m^3）.

2）Organisms 10～50μm：

It is difficult to count all the organisms for 10～50μm fraction. A practical method is to adjust the concentration of the cells to a certain value. Then 1mL of well-distributed sample were randomly taken and counted with a counting chamber. The observation on organisms' status was made with a invert microscope at the field lab. The results of identification and counting were recorded. When the counting of viable organisms was finished, Lugol's solution (the last concentration is 1%) was added to fix the samples. While part samples for deballast both in treatment tanks and control tank were stained for 3 minutes by FDA-PI dye after the samples were taken back to Qingdao and stored in dark under 4 ℃. A further identification and counting of total amount of organisms was conducted after the samples were taken back to Qingdao. Then number of cells per milliliter was calculated.

The equation is :

$$C = \frac{n \cdot V_1}{V_2 \cdot V_n}$$

where：

C——organisms number per volume of sea water unit（cells/L）；

n——organisms number of one counting unit（cells）；

V_1——sample volume after concentrated，unit（mL）；

V_2——sample filtered over small sieve，unit（L）；（influent water of control 1L，

treated water at discharge 10 L）

V_n——sample volume for counting，unit（mL）（we have two kind of counting chamber : 1mL and 0.5 mL）。

3) Organism Regrowth cultivation(MPN)method for phytoplankton (water-sample)

Most organisms would be dead after the ultra-violet irradiation. Yet some organisms can survive this irradiation through changing their life strategies such as producing spores. After certain time of adjustment, the viability of the organisms can get recovered. MPN method is used to measure the recovery of the organisms after UV-irradiation:

Sampling, storage and transportation

1.5 liter of water is collected without filtration, kept in dark plastic box and low temperature (put some ice in box), and transported to the laboratory within 3 h.

Fig.2.3 Sample bottles(1.5L) for MPN Cultivation

Fig.2.4 artificial climate incubation chamber

Water samples were mixed thoroughly and put into the 500 ml conical flask which was pre-sterilized. f/2 culture medium was added and the water samples were cultivated in the artificial climate incubation chamber under the approximate sampling seawater temperature with the light dark cycle of 12 h:12 h. Every sample has two replicates and the incubation period is 14 days.

Detection

①In vivo fluorescence

10 ml of water samples were collected every day to measure the variation of fluorescence with Turner fluorometer.

② Microscopic inspection

1 ml of water sample was collected every day to identify the species and count the number of viable individuals with a Sedgewick-Rafter counting chamber.

2.3.3 Analysis of human pathogens

Inoculation should be taken within 2h after sampling. Count the number of colonies according to the international standard.

1) Heterotrophic bacteria：plate method

Principles:

After incubation of a sample, the dispersed bacteria will develop into isolated colonies. A visible colony on solid medium represents one bacterial cell. The number of heterotrophic bacteria is obtained by counting the number of colonies. The key of this technique is to disperse the heterotrophic bacteria completely and to dilute bacterial sample to several solutions with different concentration. Small volume of diluted solution (containing 100 to 200 cells or less) is spread evenly over the surface of the solid medium.

Procedures：

1 mL Tween solution was added to 100 mL sample. The sample was well mixed to separate the organisms and kept them separated. Take 1mL of the sample with a sterile pipette to a test tube filled with 9 mL of disinfected sea water. After a thorough mixing, 0.1mL of solution was taken and inoculated on the surface of solid medium（2216E）in a Petri dish. Then it was spread evenly with a sterile, L-shaped glass rod. The dish was incubated at 25 ºC for 7d, and then it was taken out for counting the number of colonies.

2) *Vibrio cholerae*：plate technique

The total amount of vibrio is one of the important parameter for indicating water pollution levels of human pathogens. TCBS selective medium is chosen to examine the amount of vibrio. After the inoculation to the medium in a dish, the dish was incubated for a certain time under optimal conditions. Then the vibrio colonies were counted.

Procedure：

1mL of sample was pipette with sterile operation and inoculated into a test tube with BTB medium solution. It was incubated for 18h at 37 ºC. The bacterial solution shown a positive reaction was taken and lined on TCBS plate, which will be cultivated for 18h at 37 ºC. Check the number of colonies with characteristics of vibrio.

3) *Escherichia coli*： membrane filter technique

The water sample was filtered through a membrane filter. After filtration, the heterotrophic bacteria were on the membrane. Then the filter was placed on a selective solid medium and there should be no entrapment of air. After incubation, the E. coli colonies on the membrane were identified and counted. The number of E. coli per liter sea water was then worked out.

Procedure：

100 mL of sample water was filtered through an acetates membrane with pore diameter of 0.2 μm. After filtration, the heterotrophic bacteria were remained on membrane. The membrane was placed on the surface of a solid medium (M-TEC) without any entrapment of air. After 0.5 h cultivation with the plate inverted in an incubator at 37 ºC, it was transferred to another incubator with 44 ºC for a continuous cultivation of 18-24 h. The E. coli colonies on the membrane were counted and identified. The number of *E. coli* per liter sea water was then worked out.

4) *Intestinal enterococci*： membrane filter technique

PSE agar plate with selective culture medium is chosen to test the total number of

intestinal *enterococci*. After inoculation, the plate is cultivated in an incubator at 37 ºC for a certain time. The bacterial colonies with characteristics of intestinal *enterococci* were counted. The colonies may be isolated and purified for further identification. The procedure is the same as that for *Escherichia coli*.

2.3.4 Chlorophyll a and Photosynthetic activity

1）The measuring method for Chlorophyll *a* (chl-*a*)

Samples were filtered through GF/F fiberglass membranes and wrapped up with aluminum foil, saved at -20 ºC after marked until measured. Before determined, the samples were first put in a scintillation vial, then we added acetone solution (the concentration was 90%), extracting for over 12h under cold condition, after which the samples could be measured with the Turner Fluorometer. The concentration of Chl-*a* was calculated as bellow:

$$\rho_v(chl\text{-}a)=\frac{Fd\cdot(Rb-Ra)\cdot V_1}{V_2}$$

Where：

ρv(chl a) — Chla concentration of sea water. Unit: mg/m^3；

Fd —Conversion coefficient（obtained from the standard curve），unit:mg/m^3；

Rb — fluorescence reading before acidification；

Ra — fluorescence reading after acidification；

V_1 — extract volume，unit（cm^3）；

V_2 — filtered sample volume，unit（cm^3）.

2）The measuring method for photosynthetic activity(by Phyto -PAM)

The samples need a dark adaptation of 15 minutes, then determine the activity with Phyto-PAM.

A. Sample collection

a. Water samples are collected, sample-rinsed Polyethylene bottles filled by hand

b. Samples are transported to the laboratory and analyzed in 2 hours.

B. Setup

a. Turn on computer and Phyto-PAM fluorometer.

b. Turn off the Emitter-Detector Unit (ED).

c. Launch PhytoWin sofware program.

d. Check the Fluorescence values (data row F and Channels page). Values should be zero when the ED unit is off. A negligible reading of ± 8 is acceptable.

e. Click Report tab to bring up report page. Enter sample run information including date, run name and number, and collection info. Enter the Sample ID before running each sample.

f. Click Light Curve tab and turn on Blue, Green, and Brown in the Select box.

C. Sample Analysis

a.The samples need a dark adaptation of 15 minutes in ambient temperature.

b. Clean cuvette with deionized water and ethanol and dry completely, use Kimwipes to handle and clean the cuvette.

c. Transfer 3 mL of sample into the cuvette and place into ED unit. Keep ED unit cover on whenever possible. When removing the cover, be sure the ED unit is turned off.

d. Turn on the ED unit.

e. From the Channels page, press the Gain button to run automatic gain adjustment. It often takes 2 or 3 times to settle on a proper gain. Keep pressing Gain until the same reading comes up for a few consecutive times.

f. Turn off ED unit.

g. Remove cuvette, discard sample, and clean with deionized water.

h. Filter about 3 mL of sample throught a 0.2 μm filter into clean cuvette.

i. Place cuvette with filtrate into ED unit and turn it on, wait for Green Light at the bottom of the screen to come on, stable data measurement.

j. Click the Zoff button to set an automatic baseline adjustment for the sample.

k. Turn off ED unit.

l. Remove cuvette and discard filtrate.

m. Transfer 3 mL of sample (unfiltrate) into the cuvette.

n. Place in ED unit and turn it on. Wait for Green Light.

o. Click Start One button and wait for measurement. Wait for Green Light.

p. Click Chl(Fo) button and wait for measurement. Wait for Green Light.

q. Go to Light Curve page by clicking the tab. When light at bottom of page is green,click Light Curve button to initiate light curve. When curve is finished, click Fit button.

r. Go to Options Menu at top of page, and select Light Curve Fit Parameters.

s. Copy the data to a Pam Data Sheet.

t. Go to the File Menu and Save the report in the appropriate folder.

u. Return to the Channels page, click New Record button and turn off the Zoff.

2.3.5 Guidelines and Specifications followed

1) Guidelines for approval of ballast water management systems (G 8) Resolution MEPC. 174（58）
2) Supplementary guidelines for approval of ballast water management systems (G 8) Resolution（BLG 15/5/4，2010）
3) Type approval test plan for Cyeco^{TM} - Ballast Water Management System
4) The specification for oceanographic survey - Part 5: Chemistry （GB/T12763.5-2007）
5) The specification for oceanographic survey -Part 6: Biology （GB/T12763.6-2007）
6) The specification for marine monitoring-Part 4: Water quality monitoring and analysis（GB17378.4-2007）
7) The specification for marine monitoring—Part 7: Ecological survey for offshore pollution and biological monitoring（GB17378.7-2007）
8) The methods for determining Total Residual Oxidants (TRO) in sea water－spectrophotometric method⁄spectrophotometric of odine. Taiwan Central Department of characters NO.0940016101 Bulletin NIEA W453.20

9）Manual on harmful marine microalgae, G.M Hallegraeff, D.M. Anderson and A.D. Cambella. Intergovernmental oceanographic commission. Manuals and Guides 33. 1995. Paris.

10) Water quality-Detection and enumeration of intestinal *enterococci* Part 2: Membrane filtration method British Standard ISO 7899-2:2000.

11) Water quality-Detection and enumeration of Escherichia coli and coliform bacteria,

ISO 9308-1-2000.

12) An improved method to determine cell viability by simultaneous staining with fluorescein diacetate-propidium iodide. Journal of Histochemistry & Cytochemistry. Vol.33,No 1,PP.77-79.

Table 2.3 Summary of parameters, method, sensibility and guidelines of the test

Parameters	unit	MDL	Method of analysis	sensibility	Guideline
Temperature	℃	NA	a multi-parameter water quality probe	0.1℃	specification for oceanographic survey
Salinity	PSU	1.0	a multi-parameter water quality probe	0.1～0.2 PSU	specification for oceanographic survey
pH	pH	0.0	pH-metric method	0.01 pH	The specification for marine monitoring
DO	mg/L	0.1 0.2	Winkler method	0.05 mg/L	The specification for marine monitoring, specification for oceanographic survey
NTU	NTU	0.1	spectrophotometric method	0.1 NTU	specification for oceanographic survey
DOC	mg/L	0.36	high temperature combustion method	mg/L	The specification for marine monitoring
POC	mg/L	0.1	high temperature combustion method	mg/L	The specification for marine monitoring
TSS	mg/L	1.0	Weight method	mg/L	specification for oceanographic survey
TRO	ueq/L, mg/L as Cl		spectrophotometric method		Bulletin of Taiwan Environmental Protection Agency
organisms ≥50 μm	ind/ m^3	1.0	filtered and condensed with 50 μm sieve，count with microscope		specification for oceanographic survey
organisms 10～50 μm	cells/mL	1.0	filtered and condensed with 10 μm sieve，count with invert microscope		Hallegraeff.G.M,D.M. Anderson and A.D. Cambella
heterotrophic bacteria	CFU/100mL	1.0	plate method	CFU/mL	The specification for marine monitoring
E.coli	CFU/100mL	1.0	filter membrane method	CFU/mL	The specification for marine monitoring

Intestinal *Enterococci*	CFU/100mL	1.0	filter membrane method	CFU/mL	ISO 7899-2:2000 Standard Method 9230/ MM-FS-CNJ-0351 or ISO4833-2003
Vibrio cholerae	CFU/100mL	1.0	Plate method	CFU/mL	The specification for marine monitoring

2.4 Quantity control

2.4.1 Measures for quality assurance

2.4.1.1 Measures of sampling at test site for quality assurance

All samples were collected at the test site. The water samples were distributed into bottles with tags or labels. To avoid or reduce contamination, the sample bottles were cleaned with hydrochloric acid (samples for pH measurement were not included), then washed with pure water at last twice. Before sampling, the bottles were washed twice again with the sea water of test site. The sample bottles for microbes were autoclaved. The culture medium for microbe incubation were prepared in the lab. Before the test, they were disinfected at test site. Small plankton nets with 50μm and 10μm mesh size were used for filtering the organisms (>50 μm) and the organisms (10～50 μm) respectively. After that, the samples were concentrated and transferred into small sample bottles.

2.4.1.2 Measures of storage and transport of samples for quality assurance

During the operations of filtration and distribution of samples, measures against contamination were adopted. When collecting sample for POC, DOC and microbes, it is required to wear gloves. The samples, such as Chl-*a*, DOC, and POC cannot be analyzed at the test site. They were stored under frozen after pre-treatment. During transportation, they were in a cooler with dry ice. Plankton samples were fixed and the sample bottles were sealed. Then they were taken back to lab in Qingdao for further analysis.

2.4.2 Quantity control

2.4.2.1 Quantity control of analysis

- All analytical equipment used have to meet the requirements of the test，the 722 spectrophotometer、pH meter and electronic balance et al, were all examined by legal authority designated by state, equipment like microscope and fluorometer had calibration report.
- The samples need to be carefully checked prior to analysis to confirm that the samples are kept well. The inside and outside labels coincide with the records taken during the test.
- Equipment must be still in normal condition after the analysis.
- When abnormal results were suspected, the causes should be found out in time and explanation and correction should be made. There is a need to repeat the analysis if necessary.
- Except for postgraduate students, all of the staff conducting measurements and analysis should be qualified to do marine environmental monitoring with certificate. The students have to take in special technical training and their work will be supervised.

2.4.2.2 Quantity control during the test

- A technical introduction and work allocation about the test will be given to all participating staff. Everyone must clearly understand his/her responsibility for work and results.
- The equipment should be checked as soon as they were in the test site to see if everything is OK. There will be another check when the equipment was set up to see if it runs normally. The equipment will be calibrated if necessary. All these activities will be recorded.
- All samplings and analysis follow relevant valid version of standards, guidelines and specifications.
- The equipment will be checked when all work were finished. It should be in normal condition.
- If the analysis was interrupted or some changes of sampling or analysis have to be made, it should be reported first to the leader of the test. The work could be continued only if it was approved.

2.4.2.3 Quantity control of equipment used

All the equipments were examined by legal authority designated by state. The allowance should be still valid. If the equipment needs only self-examination, it should be examined by relevant experts prior to the test.

2.4.3 The raw records

1) The raw records reflect the exact results of sampling and analyses. Any change and deletion of them is strictly prohibited. The raw records of sampling have to be checked by the supervisor from Shanghai Branch, China Classification Society with his/her signature at the test site.

2) Tables with unified format should be used for taking the raw records. The use of pencil was not allowed except there is a special definition. The tables should be filled out completely with signature of the analyzer and proofreader.

3) The determination of significant digits and data processing of the raw data should strictly follow the relevant definition in the National standards of China --The Specification for Oceanographic Survey (GB/T12763-2008)and The Specification for Marine Monitoring GB17378.7-2007）

3. Results

3.1 Water quality

3.1.1 Temperature and salinity

The land-based test was carried out from July 29 to September 9. During this long period, the temperature difference was up to 3°C. The temperature range was 22.2~25.9°C for high salinity regime and 23.1~25.8 for low salinity regime. The salinity ranged from 32.1 to 33.2 for high salinity regime, while during low salinity regime testing, the salinity ranged from 21.6 to 21.9, which all meet the Guideline 8 well (Table 3.1).

3.1.2 TSS and NTU

Table 3.1 and Table 3.2 showed that the TSS of two salinity regimes met the requirement well for influent water. The average TSS value for 60 samples of the high salinity regime was 20.43 mg/L and ranged from 12.01 to 29.61mg/L, which was far beyond the defined value (>5 mg/L), the concentration of TSS in Discharge water of treated tank at discharge was 6.89 mg/L on average, which declined apparently. The average TSS value for influent water of reference tank in low salinity regime test was 55.47 mg/L and ranged from 53.05 to 59.31mg/L, for the Discharge water of treated tank, the range of TSS value was 7.57 mg/L, which showed a more apparent declination than that of high salinity test. The changes of NTU corresponded with TSS, which was also lower in Discharge water.

3.1.3 DOC and POC

The average concentration of DOC for influent water in high salinity regime test was 2.84mg/L, fluctuated from 2.00 to 3.57 mg/L, which was well above the value defined by G8. While in discharge water from treated tanks, the mean concentration of DOC declined to 1.73 mg/L, fluctuated from 1.12 to 2.11 mg/L. For the low salinity regime, the concentration of DOC fluctuated from 5.10 to 9.27 mg/L, the mean was 6.65 mg/l. Similarly, the concentration of DOC in discharge water from treated tanks declined about 60% compared with the influent water, which was more apparently than that in high salinity regime.

The concentration of POC for the two salinity regimes was 1.63 mg/L（high salinity regime） and 5.41 mg/L（low salinity regime）respectively, which all met the requirements of Guideline 8， with the treating of the system, the mean value of POC was decreased to 0.39 mg/L and 1.04 mg/L respectively.

Table 3.1 Results of water quality parameters during high salinity regime test

Cycle	Stage		T(°C)	S (PSU)	pH	DO (mg/L)	NTU	TSS (mg/L)	DOC (mg/L)	POC (mg/L)
I	Influent	Control	24.9	32.4	8.03	7.60	5.72	15.52	3.45	1.41
		Treated	25.5	32.5	8.03	7.54	4.23	10.85	2.59	1.03

	Discharge	Control	23.9	32.7	7.98	6.21	1.70	7.30	1.63	0.29
		Treated	24.4	32.5	8.00	6.73	3.03	10.30	2.57	0.47
II	Influent	Control	23.8	32.4	8.05	8.11	10.42	29.61	2.45	1.74
		Treated	22.9	32.8	8.06	7.60	6.16	16.20	2.14	1.45
	Discharge	Control	23.7	33.0	8.01	6.88	3.79	14.17	1.98	0.57
		Treated	23.2	33.0	8.00	7.20	7.95	26.18	2.17	1.11
III	Influent	Control	23.8	32.2	8.13	7.56	11.83	21.88	2.87	1.61
		Treated	24.4	32.1	8.13	7.48	6.14	13.50	2.05	1.03
	Discharge	Control	24.4	32.7	8.04	5.67	1.80	4.94	1.68	0.33
		Treated	24.5	32.8	8.07	6.20	3.51	9.77	2.29	0.63
IV	Influent	Control	23.7	33.0	8.12	7.34	12.21	22.91	2.59	1.63
		Treated	23.9	33.1	8.11	7.26	7.00	16.05	1.87	1.15
	Discharge	Control	22.2	32.9	8.05	6.31	2.00	4.93	1.45	0.41
		Treated	22.6	32.9	8.09	6.63	3.57	6.75	2.25	0.52
V	Influent	Control	23.3	33.0	8.14	7.58	4.01	12.20	2.84	1.79
		Treated	24.1	32.9	8.13	7.73	2.88	8.06	2.35	0.78
	Discharge	Control	25.0	33.2	8.05	6.45	1.59	3.13	1.88	0.33
		Treated	25.9	33.0	8.06	6.37	2.15	4.76	2.24	0.44

Table 3.2 Results of water quality parameters during high salinity regime test

Cycle	Stage		T (°C)	S (PSU)	pH	DO (mg/L)	NTU	TSS (mg/L)	DOC (mg/L)	POC (mg/L)
.VI	Influent	Control	23.7	21.6	7.98	7.58	14.04	59.31	8.16	5.68
		Treated	24.3	21.7	8.01	7.69	8.74	15.42	5.98	1.37
	Discharge	Control	25.6	21.8	7.48	5.85	6.37	3.45	2.41	0.32
		Treated	25.8	21.7	7.38	7.52	4.68	10.43	3.02	0.33
VII	Influent	Control	25.6	21.7	8.16	7.60	12.75	53.05	7.47	5.37
		Treated	25.4	21.9	8.16	7.49	10.64	20.13	4.29	4.11
	Discharge	Control	25.0	21.9	7.28	6.53	9.42	3.15	2.31	0.84
		Treated	25.0	21.9	7.22	7.18	13.71	13.61	3.32	1.23

VIII	Influent	Control	24.7	21.7	7.57	7.47	24.80	53.91	5.74	5.19
		Treated	25.0	21.7	7.59	7.56	22.28	15.04	4.28	4.21
	Discharge	Control	23.8	21.8	7.42	6.42	10.26	3.59	1.85	1.13
		Treated	24.3	21.9	7.38	6.68	11.52	6.57	2.40	1.41
IX	Influent	Control	24.0	21.6	7.94	7.89	31.45	55.17	6.52	5.82
		Treated	23.5	21.8	7.92	7.50	24.47	25.88	5.18	4.09
	Discharge	Control	23.7	21.8	7.27	5.98	6.89	10.46	1.97	1.15
		Treated	23.7	21.8	7.27	7.05	5.18	26.01	4.17	1.79
X	Influent	Control	25.4	21.3	7.84	7.43	18.82	55.89	5.38	6.27
		Treated	25.0	21.6	7.82	7.35	15.92	35.99	4.64	5.31
	Discharge	Control	23.1	21.7	7.31	5.31	13.03	17.19	2.31	1.74
		Treated	23.6	21.6	7.25	6.71	11.62	29.17	3.95	3.72

3.1.4 TRO

The TRO of one cycle for each salinity regime was determined, the results were shown in Table 3.3, which demonstrated that the mean equivalent concentration of TRO in control tank for the cycle III in the high salinity regime was 1.784 ueq./L, which was equivalent to 0.127 mg/L of Cl_2 concentration. The TRO of treated tank showed a similar value with control tank, that was 1.752 ueq./L and 0.124 mg/L, respectively. While during the low salinity regime test, the TRO of the cycle VII was a little higher than that at high salinity, the value was 3.129ueq./L for control tank and 3.072 ueq./L for treated tank respectively, which was equivalent to 0.222 mg/L and 0.218 mg/L of Cl_2 concentration. The difference between two salinity regimes might be caused by the tap water which was used to adjust salinity during the low salinity regime test. In summary, our results were higher compared with the NINA results, which might be related to the determining methods, but for the control tank and the treated tank, they did show no significant difference in TRO value.

Table 3.3 Results of TRO

Regime	Discharge Cycle	Tank	（TRO）ueq./L		Equivalent Concentration of Cl_2（mg/L）	
			mean	range	mean	range
High	III	control	1.784	1.491~2.105	0.127	0.106~0.149

salinity		treated	1.752	1.632~1.834	0.124	0.116~0.130
Low salinity	VII	control	3.129	3.070~3.158	0.222	0.218~0.224
		treated	3.072	2.951~3.183	0.218	0.210~0.226

3.2 Organisms > 50 µm

Oithona sp. and *Brachionus* sp. which were added became the dominant species of this size fraction, other species were local nature communities, mainly included: *Oithona* sp., *Paracalanus parvus*, *Acartia* sp., Nematoda, protozoa and larvae of polychaetes, etc.

Table 3.4 Density of living organisms > 50 µm (ind/m^3)

Density of viable organisms				
High salinity （>32PSU）	Influent water of control	Discharge water of control	Influent water of treated	Discharge water of treated
	C-0	C-5	T-0	T-5
I	$1.13\times10^5\pm5.77\times10^3$	$2.27\times10^4\pm3.79\times10^3$	7.33±0.58	0
II	$1.01*10^5\pm5.4\times10^2$	$9.1\times10^4\pm1.90\times10^4$	7±1	0
III	$6.63\times10^5\pm8.96\times10^4$	$7.39\times10^4\pm1.57\times10^3$	9±1	0
IV	$2.23\times10^5\pm2.60\times10^4$	$4.7\times10^4\pm2.88\times10^4$	3.67±1.15	0
V	$1.53\times10^5\pm5.77\times10^3$	$5.93\times10^4\pm1.51\times10^4$	3±2.64	0
Mean	2.5×10^5	5.88×10^4	6	0
Low salinity （<22PSU）				
VI	$1.04\times10^5\pm2.04\times10^3$	$3.03\times10^4\pm3.05\times10^3$	0.67±1.15	0
VII	$2.63\times10^5\pm3.05\times10^3$	$0.75\times10^4\pm2.50\times10^3$	2.67±2.51	0
VIII	$2.3\times10^5\pm4.58\times10^4$	$8.77\times10^4\pm1.93\times10^4$	2.67±1,52	0
IX	$2.33\times10^6\pm4.16\times10^5$	$3.93\times10^4\pm8.14\times10^4$	0.33±0.58	0
X	$7.23\times10^5\pm1.50\times10^5$	$7.93\times10^5\pm2.72*\times10^5$	7±4	0
Mean	7.29×10^5	1.92×10^5	2.67	0

The mean density of viable zooplankton for every cycle was shown in table 3.4. For the high salinity regime, the density of influent water ranged from 1.01×10^5 to 7.2×10^5

inds/m^3, and was 2.5×10^5 inds/m^3 on average, which was 7.29×10^5 inds/m^3 for the low salinity, the densities for both regimes met the G8 well. There were still more or less viable organisms determined in the influent water of treated tank for both regimes, and the mean density was 6inds/m^3 and 2.67 inds./m^3, respectively. The highest value of density came up in cycle III, during which, the density of one sample was up to 10 inds/m^3, although the viability was obviously lower than that of control tank. However, 5 days later, no viable organisms were detected, which also demonstrated that after the treatment of filtration and ultraviolet irradiation, the organisms were seriously injured, although few individuals could still move. With the second treatment of ultraviolet irradiation, all the organisms were killed, as a result, none of viable organisms was observed for both regimes.

3.3 Organisms 10 – 50 μm

Two added phytoplankton（*Platymonas helgolandica* and *Isochrysis galbana*）became the dominant species of this size fration. Most of the species in original water belonged to diatom, mainly included: *Skeletonema costatum*, *Chaetoceros* spp. and *Cylindrotheca closterium* etc. However, the diversity of dinoflagellate was significantly increased in the low salinity regime compared with the high salinity regime.

Table 3.5 Density of living organisms 10~50 μm（cells/mL）

Density of living organisms 10~50 μm（cells/mL）				
	Influent water of control	Discharge water of control	Influent water of treated	Discharge water of treated
High salinity	C-0	C-5	T-0	T-5
I	$1.26\times10^3\pm1.99\times10^2$	113.97±4.99	2.83±1.53	0
II	$1.22\times10^3\pm1.01\times10^2$	190.21±5.12×10	4.47±1.55	0.005
III	$1.14\times10^3\pm1.44\times10^2$	109.02±8.09	3.23±2.00	0
IV	$1.19\times10^3\pm7.2\times10$	119.38±1.60×10	2.37±0.58	0
V	$1.14\times10^3\pm8.9\times10$	117.93±8.87	0.9±0.58	0
Mean	1.19×10^3	130.10	2.53	0.001
Low				

salinity				
.VI	1096.71±5.90×10	217.98±2.68	0	0
VII	1397.94±1.20×10^2	184.89±1.27×10	2.33±1.00	0
VIII	1731.52±2.75×10^2	187.73±2.52×10	5.0±0.58	0
IX	1073.63±6.95×10	159.74±9.76	3.33±0.58	0
X	1041.36±3.96×10	159.08±9.92	0.33±0.58	0
Mean	1.27×10^3	182.73	1.27	0

Table 3.5 showed the results of organisms density(10-50μm) for influent and discharge water in treated and control tanks during the ten testing cycles, the mean density of influent water in control tank in high salinity regime was 1.19×103cells/ mL， while 5 days later, the number of cells in discharged waters in control tank nearly reduced by one order, which decreased to 130 cells/ mL on average; for the low salinity regime, the mean organisms density of influent water in control tanks was 1.27×103 cells/mL，while 182.73 cells/mL for the discharge water，which all met the requirement of G8。With the exception of cycle 1 in low salinity regime, viable organisms were observed during all the other cycles, that was 2.53 cells/ mL on average for the high salinity regime and 1.27cells/ mL on average for low salinity regime， which all lower than the value defined by both D-2 standard and G8. When exposed to a 5 days treatment, the number of viable organisms obviously decreased, which was only observed in one sample of discharge water of cycle II, and the density was only 0.005 cell/ mL. The density of viable organisms for the whole high salinity regime was 0.001 cell/ mL , which met the D-2 standard and the requirement of G8 completely.

3.4 Concentration of Chl-*a* and Photosynthetic activity

Chl-*a* was the main photosynthetic pigment for phytoplankton, and was an effective index to estimate the biomass of phytoplankton. The organisms (<10μm) were not included in G8; however, organisms of this size fraction were often the dominant species in nature communities, especially when bloom occurred. Besides, the size of added species *Isochrysis galbana* was also less than 10μm, in view of which, we determined the concentration of Chl-*a* and the photosynthetic activity of water samples in order to fully reflect the treatment effect.

Table 3.6 showed the results of Chl-*a* concentration which was 5.13 μg/L on average for the influent water of control tank during five cycles in high salinity regime, fluctuated from 4.02 to 6.26 μg/L，5 days later when discharged, the mean concentration of Chl-*a* decreased to 0.42 μg/L. For the treated tank, the mean Chl-*a* concentration was 3.95 μg/L at T-0, this comparatively high value might have relationship with the intact cell after treated although the cells were actually dead, because the Chl-*a* was not decomposed and could still be determined. While 5 days later when discharge, the concentration of Chl-*a* reduced to 0.12 μg/L，which was only 2.3% of the influent water of control tank. That is, the efficiency of treatment was nearly up to 98%. The Chl-*a* concentration in the low salinity regime was higher compared with that of high salinity regime, was 8.44 μg/L on average, but it was only 0.23 μg/L when discharge for the treated water, the efficiency of treatment was also over 97%.

Photosynthetic capacity (also called photosynthetic activity which was usually expressed with Fv/Fm) was an effective index to reflect the physiological status of phytoplankton. Table 3.7 showed the results of photosynthetic activity for the cycle I and II in high salinity regimes. In influent water, the value of Fv/Fm was from 0.43—0.51, which might a little lower than that of nature ecosystem or lab cultivation (the value of Fv/Fm was over 0.5). After the treatment, however, the value fluctuated from 0.02 to 0.04, nearly reduced to 0.The results obviously demonstrated that the treatment used in the present test was very effective to destroy the photosynthetic capacity of phytoplankton.

Table 3.6 Chl-*a* value in phytoplankton（μg/L）

High salinity	Influent water of control(C~0)		Discharge water of control (C~5)		Influent water of treated (T~0)		Discharge water of treated (T~5)	
(>32PSU)	Mean	Range	Mean	Range	Mean	Range	Mean	Range
I	5.79	5.54~6.26	0.21	0.14~0.25	3.99	3.67~4.14	0.11	0.09~0.13
II	5.07	4.91~5.32	0.84	0.82~0.87	3.22	2.64~4.26	0.16	0.14~0.18
III	5.31	4.99~5.58	0.47	0.39~0.55	4.85	4.40~5.52	0.15	0.12~0.18
IV	4.90	4.79~5.11	0.37	0.35~0.39	4.23	4.10~4.46	0.13	0.12~0.14
V	4.58	4.02~4.93	0.21	0.18~0.25	3.47	3.02~3.85	0.07	0.06~0.08
Average	5.13		0.42		3.95		0.12	
Low salinity（< 22 PSU）								

.VI	5.72	5.10~6.16	0.19	0.18~0.20	4.51	4.97~5.84	0.14	0.10~0.18
VII	11.28	10.73~11.93	2.51	2.42~2.61	7.72	7.43~7.96	0.34	0.32~0.35
VIII	9.83	9.25~10.27	2.31	1.91~3.33	6.94	6.13~8.10	0.31	0.28~0.33
IX	5.69	5.42~5.96	0.46	0.41~0.50	5.45	4.97~5.84	0.19	0.15~0.25
X	9.70	9.35~10.86	0.48	0.43~0.53	9.42	8.51~10.04	0.15	0.12~0.18
Average	8.44		1.19		6.81		0.23	

Table 3.7 Photosynthetic activity（Fv/Fm）

High salinity	Influent water of control(C~0)		Discharge water of control (C~5)		Influent water of treated (T~0)		Discharge water of treated (T~5)	
(>32PSU)	Mean	Range	Mean	Range	Mean	Range	Mean	Range
I	0.44	0.43-0.45	0.15	0.14-0.17	0.12	0.10-0.16	0.03	0.02-0.04
II	0.48	0.47-0.51	0.30	0.27-0.32	0.07	0.04-0.08	0.02	0.02-0.03

3.5 Phytoplankton cultivation（chlorophyll-based MPN）

Some laboratory experiment results showed that most organisms would be dead after the ultra-violet irradiation damage, yet some organisms can survive this damage through changing their life strategies such as producing spores. After certain time of adjustment, the viability of the organisms can get recovered.

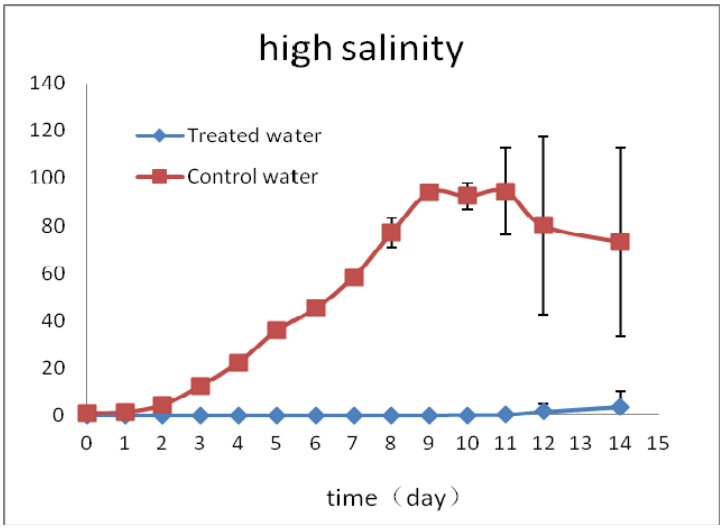
In the land-based test, two runs (5^{th} run in high salinity regime and 3^{rd} run in low salinity regime) of MPN cultivation experiments were performed, and the results were shown in figure 3-1.

The chlorophyll concentrations in the report were all obtained from the chlorophyll-based results of MPN cultivation. For the discharge water from the control tanks: In the high salinity group, the average initial Chl-*a* concentration was 0.8 μg/L. With the procession of the cultivations, the average Chl-*a* concentration increased to 94.2μg/L at day 11, with slight fluctuations among the samples. Since day 12, the Chl-*a* concentrations in 2 samples started to decrease, and showed a significant decrease at the end of the experiment although in the other 4 samples almost no Chl-*a* decrease was

observed. In the low salinity group, the Chl-*a* concentration increased consistently throughout the incubation and the average concentration reached 150.3 μg/L at the end of the experiment. No Chl-*a* concentration decrease was observed in all of the 6 samples.

For the discharge water from the treatment tanks: The initial Chl- *a* concentration varied between 0-0.2 μg/L. In the high salinity group, the Chl-*a* concentration in 14 samples was not detected. Since day 10, the Chl-*a* concentration began to gradually increased, and the value varied between 0-24.5 μg/L at the end of the experiment. In the low salinity group, the initial Chl -*a* concentration was slightly higher than that in the high salinity group, and the recovery time was about 2 days earlier than that in the high salinity group. At the end of the experiment, the Chl-*a* concentration varied between1.3-26.3 μg/L

Fig.3.1 MPN cultivation



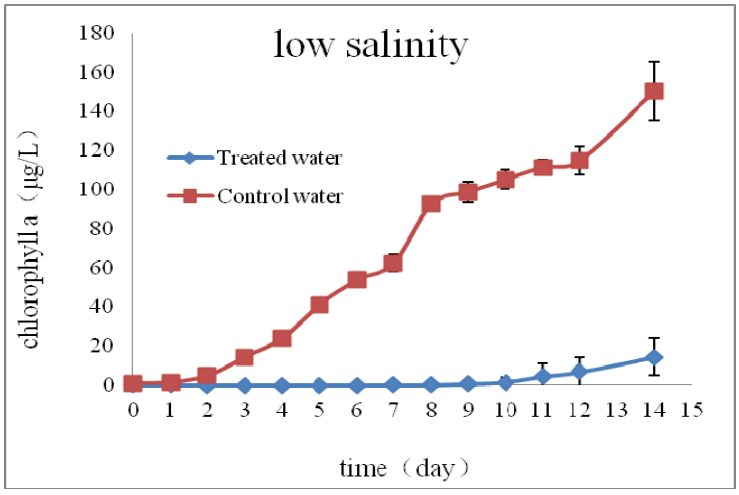


Fig.3.2 The change curve of chl- *a*

3.6 Heterotrophic bacteria

During five cycles in the high salinity regime test, the density of heterotrophic bacteria in influent water in control tank changed from 1.4×10^6 to 5.8×10^6 CFU /100mL，averaged to 3.50×10^6 CFU /100mL when discharged 5 days later, the mean density of heterotrophic bacteria reduced to 4.29×10^5 CFU /100mL; while for the treated tank, there were no viable bacteria determined in the influent water of two cycles, the mean density of heterotrophic bacteria for the rest three cycles was 3.19×10^2 CFU /100mL, fluctuated form 1.2×10^2 CFU/100mL to 1.1×10^3 CFU /100mL. With a second treatment of 5 days later, the mean density declined to 2.16×10^2 CFU /100mL. When exposed to low salinity, the number of heterotrophic bacteria in the influent water from control tank during low salinity regime test was similar, the meat density was 3.47×10^6 CFU /100mL, fluctuated from 1.1×10^6 to 6.5×10^6 CFU/100mL, 5 days later when discharge, then number which reduced to 1.57×10^6 CFU /100mL nearly cut by half; for the treated tank, viable heterotrophic bacteria was not determined in two and three cycles at T0 and T5 respectively. Although there were viable heterotrophic bacteria in other cycles, the mean densities were all below 300 CFU/100mL, which met the D-2 standard and the requirement of G8 completely.

Table 3.8 density of heterotrophic bacteria（CFU/100mL）

density（CFU/100mL）				
High salinity	Influent water of control	Discharge water of control	Influent water of treated	Discharge water of treated

	C-0	C-5	T-0	T-5
I	$5.17\times10^6\pm7.77\times10^5$	$3.8\times10^6\pm5.57\times10^5$	0	0
II	$2.73\times10^6\pm6.66\times10^5$	$5.13\times10^5\pm6.81\times10^5$	0	0
III	$4.70\times10^6\pm5.57\times10^5$	$5.17\times10^5\pm1.19\times10^5$	$8.03\times10^2\pm2.95\times10^2$	$3.87\times10^2\pm2.40\times10^2$
IV	$2.97\times10^6\pm6.66\times10^5$	$5.37\times10^5\pm5.51\times10^4$	$5.60\times10^2\pm9.85\times10$	$4.20\times10^2\pm6.56\times10$
V	$1.97\times10^6\pm5.13\times10^5$	$1.97\times10^5\pm5.51\times10^4$	$2.30\times10^2\pm1.15\times10^2$	$2.73\times10^2\pm2.31\times10$
Mean	3.50×10^6	4.29×10^5	3.19×10^2	2.16×10^2
Low salinity				
.VI	$2.37\times10^6\pm4.93\times10^5$	$4.93\times10^5\pm7.77\times10^4$	$2.77\times10^2\pm6.66\times10$	$3.20\times10^2\pm8.72\times10$
VII	$1.33\times10^6\pm2.52\times10^5$	$1.73\times10^6\pm4.04\times10^5$	$3.87\times10^2\pm1.19\times10^2$	$3.17\times10^2\pm1.96\times10^2$
VIII	$1.47\times10^6\pm2.52\times10^5$	$2.00\times10^6\pm5.00\times10^5$	$3.97\times10^2\pm2.14\times10^2$	0
IX	$6.00\times10^6\pm5.00\times10^5$	$5.20\times10^5\pm6.56\times10^4$	0	0
X	$6.17\times10^6\pm3.51\times10^5$	$3.10\times10^6\pm3.61\times10^5$	0	0
Mean	3.47×10^6	1.57×10^6	2.12×10^2	1.27×10^2

3.7 Human pathogens

The common bacterial populations of human pathogens included *Vibrio cholerae*, Intestinal *enterococci* and *Escherichia coli*, etc. Table 3.9 showed the variance of Escherichia coli during the ballast water treatment, which demonstrated that the density of Escherichia coli in original water was low, that was 3.78×10^2 CFU/100mL on average for the influent water of control tank in high salinity regime, varied from 2.3×10^2 to 6.6×10^2 CFU/100mL，5 days later when discharge, the mean density turned to 3.61×10^2 CFU/100mL. But for low salinity regime, the density was one order of magnitude higher than that of high salinity regime, that was 3.3×10^3 CFU/100mL on average，5 days later when discharge, the density increased to 1.07×10^4 CFU/100mL. As to the treated tank, viable Escherichia coli was only observed in three samples of one cycle at T0 during the high salinity regime test, and the mean density was 56.7 CFU/100mL, compared with 50~120 CFU/100mL for the three cycles of low salinity regime. After the second treatment of 5 days later, no viable Escherichia coli colonies were incubated from the water samples of two regimes, which met the D-2 standard and the requirement of G8 completely.

Table 3.9 Number of *E. coli* （CFU/100mL）

E. coli CFU（CFU/100mL）				
High salinity	Influent water of control	Discharge water of control	Influent water of treated	Discharge water of treated
	C-0	C-5	T-0	T-5
I	$4.90\times10^2\pm1.43\times10^2$	$2.40\times10^2\pm2.00\times10$	0	0
II	$2.93\times10^2\pm7.77\times10$	$4.53\times10^2\pm7.51\times10$	0	0
III	$3.50\times10^2\pm7.00\times10$	$5.13\times10^2\pm6.03\times10$	0	0
IV	$3.77\times10^2\pm6.66\times10$	$4.60\times10^2\pm1.05\times10^2$	0	0
V	$3.80\times10^2\pm4.00\times10$	$1.37\times10^2\pm1.53\times10$	$5.67\times10\pm2.08\times10$	0
Mean	3.78×10^2	3.61×10^2	11.34	
Low salinity				
.VI	$6.83\times10^2\pm1.55\times10^2$	$2.40\times10^2\pm1.73\times10$	0	0
VII	$4.83\times10^2\pm3.06\times10$	$1.67\times10^3\pm5.03\times10^2$	$1.10\times10^2\pm1.00\times10$	0
VIII	$5.03\times10^2\pm5.03\times10^2$	$8.37\times10^3\pm1.20\times10^3$	$8.67\times10\pm1.53\times10$	0
IX	$7.40\times10^3\pm7.55\times10^2$	$2.23\times10^4\pm1.53\times10^3$	$8.67\times10\pm3.21\times10$	0
X	$7.57\times10^3\pm8.50\times10^2$	$2.10\times10^4\pm4.58\times10^3$	0	0
Mean	3.33×10^3	1.07×10^4	56.68	

Table 3.10 showed the number of Intestinal enterococci during the test. During the high salinity regime, the number of Intestinal enterococci which was 4.88×10^2 CFUS/100mL on average for influent water was similar to the number of E. coli, 5 days later when discharged, the number decreased more than half. During the low salinity regime, the number of Intestinal enterococci was a little higher, which was 4.13×10^3 CFU/100mL on average in influent water and 3.26×10^3CFU/100mL at discharge. For the treated tank, none Intestinal Enterococci colonies were observed either at T0 or T5.

Table 3.11 showed the number of *Vibrio* spp (include *V. cholerae*), for influent water of control tank, the density of *Vibrio* spp. was 2.4×10^3~9.2×10^3 CFUs/100mL and 4.4×10^4~3.8×10^5 CFU/100mL for the two regimes respectively， compared with 1.59×10^4CFUs/100mL and 1.59×10^5 CFUs/100mL in treated tank. 5 days later the density turned to 5.45×10^3 CFUs/100mL for high salinity regime and 1.20×10^5

CFU/100mL for low salinity regime. For the treated tank, none *Vibrio cholerae* colonies were observed either at T0 or T5.

Table3.10 Number of Intestinal *Enterococci* CFU（CFU/100mL）

Intestinal *enterococci* （CFU/100mL）				
High salinity	Influent water of control	Discharge water of control	Influent water of treated	Discharge water of treated
	C-0	C-5	T-0	T-5
I	$4.30\times10^{2}\pm1.01\times10^{2}$	$7.33\times10^{1}\pm1.53\times10$	0	0
II	$1.53\times10^{3}\pm3.79\times10$	$1.67\times10^{2}\pm5.03\times10$	0	0
III	$1.63\times10^{2}\pm2.08\times10$	$1.57\times10^{2}\pm3.06\times10$	0	0
IV	$8.67\times10^{1}\pm2.52\times10$	$1.17\times10^{2}\pm3.06\times10$	0	0
V	$2.30\times10^{2}\pm5.57\times10$	$5.97\times10^{2}\pm1.45\times10^{2}$	0	0
Mean	4.88×10^{2}	2.22×10^{2}		
Low salinity				
.VI	$4.40\times10^{3}\pm1.00\times10^{3}$	$8.57\times10^{2}\pm4.95\times10$	0	0
VII	$4.07\times10^{3}\pm3.51\times10^{2}$	$4.00\times10^{3}\pm7.94\times10^{2}$	0	0
VIII	$3.30\times10^{3}\pm3.61\times10^{2}$	$3.43\times10^{3}\pm8.02\times10^{2}$	0	0
IX	$5.17\times10^{3}\pm6.11\times10^{2}$	$6.23\times10^{3}\pm5.51\times10^{2}$	0	0
X	$3.73\times10^{3}\pm5.51\times10^{2}$	$1.77\times10^{3}\pm4.04\times10^{2}$	0	0
Mean	4.13×10^{3}	3.26×10^{3}		

Table 3.11 Number of *Vibrio* spp.(include *V. cholera*)（CFU/100mL）

Vibrio spp.（CFU/100mL）				
High salinity	Influent water of control	Discharge water of control	Influent water of treated	Discharge water of treated
	C-0	C-5	T-0	T-5
I	$2.80\times10^{3}\pm5.29\times10^{2}$	$7.53\times10^{3}\pm9.29\times10^{2}$	0	0
II	$6.00\times10^{3}\pm2.02\times10^{3}$	$5.47\times10^{3}\pm9.45\times10^{2}$	0	0
III	$8.37\times10^{3}\pm8.50\times10^{2}$	$7.03\times10^{3}\pm7.09\times10^{2}$	0	0
IV	$5.67\times10^{4}\pm7.09\times10^{3}$	$4.50\times10^{3}\pm1.21\times10^{3}$	0	0
V	$5.70\times10^{3}\pm1.47\times10^{3}$	$2.73\times10^{3}\pm6.81\times10^{2}$	0	0
Mean	1.59×10^{4}	5.45×10^{3}		
Low salinity				
.VI	$4.80\times10^{4}\pm4.00\times10^{3}$	$1.53\times10^{4}\pm2.52\times10^{3}$	0	0
VII	$7.40\times10^{4}\pm9.17\times10^{3}$	$6.80\times10^{4}\pm3.00\times10^{3}$	0	0

VIII	$7.87\times10^4\pm2.08\times10^3$	$2.43\times10^5\pm4.16\times10^4$	0	0
IX	$2.53\times10^5\pm3.06\times10^4$	$8.63\times10^4\pm2.22\times10^4$	0	0
X	$3.40\times10^5\pm3.61\times10^4$	$1.87\times10^5\pm4.04\times10^4$	0	0
Mean	1.59×10^5	1.20×10^5		

4. Conclusions

The land-based testing of BWMS manufactured by Shanghai Cyeco Environmental Technology Co.Ltd. was conducted at Shidao Port of Shandong Province from July 2011 to September 2011. According to the testing results and the reference of G8 and D2 standard (Table 4.1), the conclusion was made as follows:

1. During the test, the temperature of water samples varied from 22.2℃ to 25.9℃, the mean salinity was 32.6 PSU and 21.7 PSU for the two regimes respectively；what's more, the TSS concentration was 20.43 mg/L for high salinity regime and 55.47mg/L for low salinity regime；DOC concentration was 2.84mg/L（high salinity regime）and 6.65 mg/L（low salinity regime）；POC concentration was 1.63 mg/L（high salinity regime）and 5.41 mg/L（low salinity regime），all met the requirements of G8 Guideline.

2. Besides the *Oithona* sp. and *Brachionus* sp. which were added, other species of ≥50μ were local nature communities, mainly included: *Oithona* sp., *Paracalanus parvus*, *Acartia* sp., Nematoda, Protozoa and larvae of polychaetes, etc. which were well above the requirements of at least 5 species from at least 3 different phyla/divisions of G8. The density of this size fraction for influent water of control tank was 2.5×10^5inds/m3 and 7.29×10^5 inds/m^3 for the two regimes respectively, which met the requirements of G8. No viable organisms of this size fraction were observed in the treated water, which met the D-2 standard.

3.Two added phytoplankton（*Platymonas helgolandica* and *Isochrysis galbana*）became the dominant species of this size. What's more, most of the species in nature original water belonged to diatom, mainly included: *Skeletonema costatum*, *Chaetoceros* spp. and *Cylindrotheca closterium* etc., the number of species met the requirement of G8. The density of this size fraction for influent water of control tank was 1.19×10^3cells/ mL and

1.27×10^3cells/ mL for the two regimes respectively, viable organisms of this size fraction was only observed in one treated water sample during the high salinity regime, and the density of viable organisms was 0.005cell/mL，which met the requirements of G8 and D-2 standard. The survival organism after treatment at low salinity regime was 0 cell/mL.

4. chlorophyll-based results of MPN cultivation showed that the recovery of the phytoplankton after UV-irradiation were slowly and the Chl-*a* concentration began to gradually increased (0-24.5 μg/L) since day 10.

5. Heterotrophic bacteria were abundant in influent water before treated, the density of all the samples were above 106 CFU/100mL, which met the requirements of G8 well. Although there is no clearly definition for the number of heterotrophic bacteria after treatment, the number of heterotrophic bacteria after treatment for high and low salinity regime was 2.12×10^2 CFU/100 mL and 1.27×10^2 CFU/100 mL respectively. As to the *E. coli*, the density of which in influent water of control tank was 3.78×10^2 CFU/100mL and 3.3×103 CFU/100mL for the two salinity regimes, while viable *E. coli* was only observed in three samples of one cycle of treated tank at T-0 during the high salinity regime test, and the mean density was 56.7 CFU/100mL, after the second treatment of 5 days later, no viable E. coli colonies were incubated from the water samples of two regimes; for the *V. cholerae* and Intestinal. *enterococci*, no survival colonies were observed for all 30 treated water samples. In one ward, all results of microbes met the D-2 standard and the requirement of G8 completely.

Table 4.1 Comparison of testing results of Cyeco^{TM}-ballast treatment water with D2 standard and G8

	Parameters	G8 and D-2 standard			Determining results			Assessment
		Influent water	Discharge water of control	Discharge water of treated	Influent water	Discharge water of control	Discharge water of treated	
＞32PSU	（DOC）mg/l	＞1	N/A	N/A	2.84	2.20	1.73	meet the Guideline 8
	（POC）mg/l	＞1	N/A	N/A	1.63	2.22	0.39	meet the Guideline 8
	（TSS）mg/l	＞1	N/A	N/A	20.43	12.93	6.89	meet the Guideline 8
	≥50 μm (ind./m^3)	＞10^5	＞100	<10	2.5×10^5	5.88×10^4	No living organism	meet D2 standard and Guideline 8
	10-50 μm (cells/mL)	＞10^3	＞100	<10	1.19×10^3	130.10	0.001	meet D2 standard and Guideline 8
	Bacteria(CFU/100mL)	＞10^6	N/A	No definition	3.50×10^6	4.29×10^5	2.16×10^2	meet D2 standard and Guideline 8
	Escherichia coli(CFU/100mL)	N/A	N/A	<250	3.78×10^2	3.61×10^2	0	meet D2 standard and Guideline 8
	Intestinal *Enterococci*(CFU/100mL)	N/A	N/A	<100	4.88×10^2	2.22×10^2	0	meet D2 standard and Guideline 8
	Vibrio choleerae(CFU/100mL)	N/A	N/A	<1	1.59×10^4	5.45×10^3	0	meet D2 standard and Guideline 8
3-22PSU	（DOC）mg/l	＞5	N/A	N/A	6.65	4.88	2.17	meet the Guideline 8
	（POC）mg/l	＞5	N/A	N/A	5.41	3.82	1.04	meet the Guideline 8
	（TSS）mg/l	＞50	N/A	N/A	55.47	22.49	7.57	meet the Guideline 8
	≥50 μm (ind./m^3)	＞10^5	＞100	<10	7.29×10^5	1.92×10^5	No living organism	meet D2 standard and Guideline 8
	10-50 μm (cells/mL)	＞10^3	＞100	<10	1.27×10^3	182.73	No living organism	meet D2 standard and Guideline 8
	Bacteria(CFU/100mL)	＞10^6	N/A	No definition	3.47×10^6	1.57×10^6	1.27×10^2	meet D2 standard and Guideline 8
	Escherichia coli(CFU/100mL)	N/A	N/A	<250	3.33×10^3	1.07×10^4	0	meet D2 standard and Guideline 8
	Intestinal *Enterococci*(CFU/100mL)	N/A	N/A	<100	4.13×10^3	3.26×10^3	0	meet D2 standard and Guideline 8
	Vibrio spp.((CFU/100mL)	N/A	N/A	<1	1.59×10^5	1.20×10^5	0	meet D2 standard and Guideline 8

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6 Appendix：

Appendix 1. Results for environmental paramenters of the Land-based Testing of Cyeco™-BWMS（〉32PSU）

Sampling date	Test run	Tank	Sample number	Temperature (°C)	Salinity (PSU)	pH	DO (mg/L)	NTU	TSS(mg/L)	DOC(mg/L)	POC(mg/L)
2011.07.30	Influent water of the 1st test run	Control	I-C1-SP1-B/d	25.3	32.4	8.02	7.76	5.35	14.64	3.52	1.48
			I-C1-SP1-M/d	25.3	32.5	8.03	7.71	6.54	17.31	3.27	1.29
			I-C1-SP1-E/d	24.0	32.4	8.04	7.33	5.26	14.60	3.56	1.45
		Treatment	I-C1-SP2-B/d	25.3	32.4	8.03	8.19	3.42	9.77	2.78	1.01
			I-C1-SP2-M/d	25.5	32.5	8.03	7.23	4.43	10.47	2.20	1.06
			I-C1-SP2-E/d	25.8	32.5	8.02	7.19	4.82	12.30	2.79	1.03
2011.08.04	Effluent water of the 1st test run	Treatment	I-C1-SP3-B/d	23.8	32.7	7.97	6.19	1.80	7.94	1.83	0.26
			I-C1-SP3-M/d	23.9	32.6	7.97	6.14	1.27	6.90	1.70	0.32
			I-C1-SP3-E/d	24.0	32.7	7.99	6.31	2.02	7.05	1.37	0.30
		Control	I-C1-SP4-B/d	24.7	32.3	7.99	6.72	2.32	9.58	2.65	0.57
			I-C1-SP4-M/d	24.3	32.5	8.00	6.80	3.18	10.63	2.59	0.37
			I-C1-SP4-E/d	24.1	32.7	8.00	6.67	3.59	10.69	2.47	0.47
2011.07.31	Influent water of the 2nd test run	Control	I-C2-SP1-B/d	22.9	32.5	8.05	8.11	12.59	37.08	2.49	1.70
			I-C2-SP1-M/d	24.5	32.3	8.07	7.93	8.51	24.87	2.45	1.75
			I-C2-SP1-E/d	24.1	32.5	8.04	8.30	10.15	26.88	2.42	1.76
		Treatment	I-C2-SP2-B/d	22.7	32.5	8.06	8.03	5.75	13.34	2.15	1.51
			I-C2-SP2-M/d	23.6	33.0	8.05	7.33	5.44	15.17	2.18	1.35
			I-C2-SP2-E/d	22.3	33.0	8.06	7.44	7.28	20.08	2.09	1.50
2011.08.05	Effluent water of the 2nd test run	Treatment	I-C2-SP3-B/d	23.5	33.0	8.01	6.64	4.96	17.50	2.11	0.53
			I-C2-SP3-M/d	23.9	33.0	8.01	7.78	2.76	14.00	1.81	0.52
			I-C2-SP3-E/d	23.8	33.0	8.01	6.20	3.64	11.00	2.03	0.66
		Control	I-C2-SP4-B/d	23.4	32.9	7.99	6.94	7.19	25.50	2.22	1.31
			I-C2-SP4-M/d	23.0	33.0	8.01	7.28	9.04	27.00	2.02	0.96
			I-C2-SP4-E/d	23.3	33.0	8.01	7.39	7.63	26.03	2.26	1.07

Analyst 谢[illegible]　　Proofreader 孙霞

Appendix 1. Results for environmental paramenters of the Land-based Testing of Cyeco™-BWMS（〉32PSU）

Sampling date	Test run	Tank	Sample number	Temperature (°C)	Salinity (PSU)	pH	DO (mg/L)	NTU	TSS(mg/L)	DOC(mg/L)	POC(mg/L)
2011.08.13	Influent water of the 3rd test run	Control	I-C3-SP1-B/d	23.9	32.3	8.13	7.49	13.42	27.20	2.78	1.51
			I-C3-SP1-M/d	23.6	32.3	8.13	7.44	10.13	14.05	3.00	1.54
			I-C3-SP1-E/d	23.8	31.9	8.13	7.77	11.95	24.40	2.82	1.78
		Treatment	I-C3-SP2-B/d	24.4	32.2	8.13	7.60	8.03	14.50	2.07	1.11
			I-C3-SP2-M/d	24.5	32.0	8.14	7.57	5.31	12.50	2.09	1.00
			I-C3-SP2-E/d	24.3	32.1	8.13	7.28	5.09	13.50	2.00	0.98
2011.08.18	Effluent water of the 3rd test run	Treatment	I-C3-SP3-B/d	24.4	32.8	8.05	5.90	1.93	4.80	1.73	0.25
			I-C3-SP3-M/d	24.3	32.7	8.04	5.64	1.75	7.20	1.58	0.36
			I-C3-SP3-E/d	24.5	32.6	8.04	5.47	1.71	2.81	1.74	0.39
		Control	I-C3-SP4-B/d	24.7	32.7	8.07	6.31	2.75	9.50	2.44	0.54
			I-C3-SP4-M/d	24.1	33.1	8.08	6.24	4.28	10.50	2.13	0.69
			I-C3-SP4-E/d	24.8	32.7	8.07	6.05	3.49	9.32	2.30	0.66
2011.08.14	Influent water of the 4th test run	Control	I-C4-SP1-B/d	24.0	32.9	8.12	7.43	13.07	26.01	3.57	1.69
			I-C4-SP1-M/d	23.7	32.9	8.12	7.07	12.90	26.40	2.00	1.60
			I-C4-SP1-E/d	23.5	33.1	8.12	7.52	10.66	16.33	2.21	1.59
		Treatment	I-C4-SP2-B/d	23.8	33.0	8.10	7.48	7.18	18.30	1.92	1.11
			I-C4-SP2-M/d	23.9	33.2	8.12	7.23	6.91	16.29	1.86	1.20
			I-C4-SP2-E/d	24.0	33.0	8.12	7.05	6.91	13.57	1.82	1.15
2011.08.19	Effluent water of the 4th test run	Treatment	I-C4-SP3-B/d	22.4	32.7	8.07	6.40	2.41	5.63	1.66	0.38
			I-C4-SP3-M/d	22.1	32.8	8.05	6.38	2.37	4.95	1.12	0.43
			I-C4-SP3-E/d	22.2	33.2	8.03	6.16	1.23	4.20	1.57	0.42
		Control	I-C4-SP4-B/d	22.4	33.0	8.07	6.63	3.77	8.30	2.73	0.47
			I-C4-SP4-M/d	22.5	32.8	8.10	6.48	3.46	6.29	2.04	0.54
			I-C4-SP4-E/d	22.9	32.8	8.11	6.79	3.46	5.66	2.00	0.56

Analyst _____ Proofreader _____

Appendix 1. Results for environmental paramenters of the Land-based Testing of Cyeco™-BWMS（〉32PSU）

Sampling date	Test run	Tank	Sample number	Temperature (°C)	Salinity (PSU)	pH	DO (mg/L)	NTU	TSS(mg/L)	DOC(mg/L)	POC(mg/L)
2011.08.20	Influent water of the 5th test run	Control	I-C5-SP1-B/d	23.5	33.1	8.14	7.49	4.20	12.37	2.74	1.78
			I-C5-SP1-M/d	23.1	33.2	8.13	7.47	3.55	11.83	3.00	1.88
			I-C5-SP1-E/d	23.4	32.8	8.14	7.77	4.29	12.40	2.79	1.73
		Treatment	I-C5-SP2-B/d	24.2	33.3	8.13	7.76	2.72	7.89	2.41	0.80
			I-C5-SP2-M/d	24.1	32.7	8.13	7.59	2.85	9.49	2.37	0.69
			I-C5-SP2-E/d	23.9	32.7	8.13	7.84	3.07	6.81	2.27	0.85
2011.08.25	Effluent water of the 5th test run	Treatment	I-C5-SP3-B/d	25.3	33.2	8.06	6.40	1.36	2.76	1.96	0.35
			I-C5-SP3-M/d	24.9	33.2	8.05	6.38	1.75	3.66	1.81	0.31
			I-C5-SP3-E/d	24.9	33.2	8.05	6.58	1.67	2.97	1.88	0.34
		Control	I-C5-SP4-B/d	26.9	32.6	8.05	6.34	2.06	4.41	2.41	0.41
			I-C5-SP4-M/d	25.7	33.2	8.06	6.27	2.15	5.61	2.13	0.43
			I-C5-SP4-E/d	25.0	33.3	8.07	6.51	2.24	4.26	2.17	0.48

Analyst 潘[illegible] Proofreader 孙[illegible]

Appendix2. Results for environmental paramenters of the Land-based Testing of Cyeco^{TM}-BWMS（3-22PSU）

Sampling date	Test run	Tank	Sample number	Temperature (°C)	Salinity (PSU)	pH	DO (mg/L)	NTU	TSS(mg/L)	DOC(mg/L)	POC(mg/L)
2011.08.21	Influent water of the 1st test run	Control	II-C1-SP1-B/d	24.0	21.9	7.97	7.51	11.84	61.65	9.27	5.92
			II-C1-SP1-M/d	23.5	21.4	7.98	7.63	14.56	57.42	7.57	5.28
			II-C1-SP1-E/d	23.7	21.5	8.00	7.60	15.70	58.85	7.66	5.85
		Treatment	II-C1-SP2-B/d	24.0	22.0	8.01	7.73	8.42	15.24	6.58	1.21
			II-C1-SP2-M/d	24.3	21.8	8.01	7.70	9.47	15.23	5.53	1.74
			II-C1-SP2-E/d	24.7	21.2	8.01	7.65	8.33	15.79	5.82	1.17
2011.08.26	Effluent water of the 1st test run	Treatment	II-C1-SP3-B/d	25.8	21.7	7.48	6.05	7.81	3.60	2.52	0.27
			II-C1-SP3-M/d	25.9	21.9	7.49	5.82	5.53	3.79	2.13	0.37
			II-C1-SP3-E/d	25.1	21.7	7.48	5.67	5.79	2.97	2.59	0.32
		Control	II-C1-SP4-B/d	26.6	21.6	7.42	7.36	4.21	9.56	2.70	0.34
			II-C1-SP4-M/d	25.4	21.8	7.38	7.70	5.44	7.90	3.90	0.35
			II-C1-SP4-E/d	25.3	21.8	7.35	7.49	4.39	13.85	2.47	0.30
2011.08.27	Influent water of the 2nd test run	Control	II-C2-SP1-B/d	26.0	21.7	8.17	7.82	14.39	51.57	8.90	5.19
			II-C2-SP1-M/d	25.4	21.7	8.17	7.47	12.11	49.13	6.69	5.05
			II-C2-SP1-E/d	25.5	21.7	8.15	7.52	11.75	58.46	6.81	5.88
		Treatment	II-C2-SP2-B/d	25.3	22.0	8.16	7.49	9.47	20.99	4.11	4.37
			II-C2-SP2-M/d	25.3	21.8	8.16	7.59	13.25	18.56	4.43	3.62
			II-C2-SP2-E/d	25.6	21.8	8.16	7.40	9.21	20.84	4.34	4.35
2011.09.01	Effluent water of the 2nd test run	Treatment	II-C2-SP3-B/d	24.8	21.9	7.27	6.39	12.02	2.96	1.84	0.78
			II-C2-SP3-M/d	25.0	21.9	7.28	6.87	8.60	2.81	2.25	0.89
			II-C2-SP3-E/d	25.1	21.9	7.28	6.33	7.63	3.68	2.83	0.85
		Control	II-C2-SP4-B/d	25.3	21.8	7.21	6.77	13.33	10.71	3.31	1.20
			II-C2-SP4-M/d	24.9	22.0	7.22	7.58	12.98	13.64	3.69	1.22
			II-C2-SP4-E/d	24.8	22.0	7.22	7.17	14.82	16.47	2.95	1.28

Analyst 郭林萍 Proofreader 孙霞

Appendix2. Results for environmental paramenters of the Land-based Testing of Cyeco™-BWMS（3-22PSU）

Sampling date	Test run	Tank	Sample number	Temperature (°C)	Salinity (PSU)	pH	DO (mg/L)	NTU	TSS(mg/L)	DOC(mg/L)	POC(mg/L)
2011.08.28	Influent water of the 3rd test run	Control	II-C3-SP1-B/d	25.0	21.5	7.57	7.49	24.12	53.99	5.18	5.11
			II-C3-SP1-M/d	24.5	21.8	7.57	7.41	24.56	54.26	6.56	5.06
			II-C3-SP1-E/d	24.7	21.7	7.57	7.50	25.70	53.47	5.48	5.40
		Treatment	II-C3-SP2-B/d	24.6	21.8	7.58	7.49	22.19	14.79	4.93	4.26
			II-C3-SP2-M/d	25.3	21.6	7.57	7.71	22.19	17.07	4.09	4.12
			II-C3-SP2-E/d	25.2	21.6	7.61	7.49	22.46	13.24	3.84	4.26
2011.09.02	Effluent water of the 3rd test run	Treatment	II-C3-SP3-B/d	24.1	21.7	7.44	6.30	10.26	4.78	1.84	1.13
			II-C3-SP3-M/d	23.8	21.8	7.42	6.25	10.35	2.90	2.02	1.18
			II-C3-SP3-E/d	23.5	21.9	7.41	6.71	10.18	3.10	1.68	1.09
		Control	II-C3-SP4-B/d	24.8	21.8	7.37	6.65	10.61	6.26	2.13	1.44
			II-C3-SP4-M/d	24.3	21.9	7.37	6.37	10.53	7.12	2.42	1.59
			II-C3-SP4-E/d	23.9	22.0	7.40	7.00	13.42	6.34	2.65	1.21
2011.09.03	Influent water of the 4th test run	Control	II-C4-SP1-B/d	23.9	21.6	7.93	8.53	29.61	50.19	8.69	6.18
			II-C4-SP1-M/d	24.0	21.6	7.95	7.65	30.53	54.46	5.39	5.87
			II-C4-SP1-E/d	24.0	21.6	7.95	7.48	34.21	60.85	5.48	5.40
		Treatment	II-C4-SP2-B/d	23.6	21.7	7.92	7.38	25.00	32.25	4.40	4.58
			II-C4-SP2-M/d	23.2	21.8	7.92	7.43	23.82	20.43	4.21	4.06
			II-C4-SP2-E/d	23.6	21.9	7.91	7.68	24.61	24.97	6.94	3.61
2011.09.08	Effluent water of the 4th test run	Treatment	II-C4-SP3-B/d	24.0	21.7	7.27	6.04	7.37	10.05	2.10	1.32
			II-C4-SP3-M/d	23.6	21.9	7.26	6.10	6.71	10.22	2.48	1.23
			II-C4-SP3-E/d	23.5	21.8	7.27	5.80	6.58	11.12	1.33	0.92
		Control	II-C4-SP4-B/d	23.9	21.7	7.30	7.15	5.13	36.10	4.18	2.71
			II-C4-SP4-M/d	23.6	21.8	7.24	7.10	5.39	23.07	3.75	1.50
			II-C4-SP4-E/d	23.5	22.0	7.26	6.90	5.00	18.85	4.58	1.15
Sampling date	Test run	Tank	Sample number	Temperature (°C)	Salinity (PSU)	pH	DO (mg/L)	NTU	TSS(mg/L)	DOC(mg/L)	POC(mg/L)

Analyst 谢珊珊 Proofreader 孙霞

Appendix2. Results for environmental paramenters of the Land-based Testing of Cyeco^{TM}-BWMS (3-22PSU)

2011.09.04	Influent water of the 5th test run	Control	II-C5-SP1-B/d	26.5	21.2	7.86	7.61	19.08	56.87	5.10	6.36
			II-C5-SP1-M/d	24.9	21.5	7.83	7.42	19.47	58.31	5.67	6.49
			II-C5-SP1-E/d	24.7	21.2	7.83	7.27	17.89	52.50	5.38	5.96
		Treatment	II-C5-SP2-B/d	25.7	21.5	7.81	7.41	15.26	34.70	5.06	5.09
			II-C5-SP2-M/d	24.8	21.8	7.82	7.25	16.71	36.39	4.07	5.57
			II-C5-SP2-E/d	24.6	21.5	7.83	7.40	15.79	36.87	4.80	5.26
2011.09.09	Effluent water of the 5th test run	Treatment	II-C5-SP3-B/d	23.2	21.6	7.31	5.07	13.03	18.32	2.25	2.00
			II-C5-SP3-M/d	23.0	21.7	7.31	5.32	13.29	14.88	2.31	1.31
			II-C5-SP3-E/d	23.0	21.8	7.31	5.54	12.76	18.37	2.36	1.92
		Control	II-C5-SP4-B/d	23.9	21.5	7.18	6.25	10.92	30.11	3.60	3.43
			II-C5-SP4-M/d	23.7	21.8	7.28	6.86	11.71	23.81	4.80	3.25
			II-C5-SP4-E/d	23.2	21.6	7.29	7.03	12.24	33.60	3.45	4.46

Analyst [signature] Proofreader [signature]

Appendix 3. Results for oaganisms(＞50μm) of the Land-based Testing of Cyeco^{TM}-BWMS（>32PSU）

Sampling date	Test run	Sample number	Filter volume(m^3)	Dominant Species	Aalive density（ind.·m^{-3}）	Dead density（ind.·m^{-3}）	Total alive density（ind.·m^{-3}）	Total dead density（ind.·m^{-3}）	Total density（ind.·m^{-3}）
2011.07.30	Influent water of the 1st test run	Ⅰ-C1-SP1-B/a	0.02	*Oithona* sp.	59000		$1.17*10^5$		$1.17*10^5$
				late Nauplius larvae	43000				
				Brachionus sp.	14000				
				Harpacticoida sp.	1000				
				Acartia sp.	50				
		Ⅰ-C1-SP1-M/a	0.02	*Oithona* sp.	49000		$1.05*10^5$		$1.05*10^5$
				late Nauplius larvae	41000				
				Brachionus sp.	14000				
				Acartia sp.	1000				
				Nematoda	50				
				Protozoa	800				
		Ⅰ-C1-SP1-E/a	0.02	*Oithona* sp.	59000		$1.24*10^5$		$1.24*10^5$
				late Nauplius larvae	33000				
				Brachionus sp.	27000				
				Acartia sp.	1000				
				Protozoa	4000				
				Polychaeta larvae	50				
	Treated water of the 1st test run at intake	Ⅰ-C1-SP2-B/a	1	*Oithona* sp.	7	270	7	342	349
				late Nauplius larva		70			
				Acartia sp.		1			
				Nematoda		1			
		Ⅰ-C1-SP2-M/a	1	*Oithona* sp.	6	530	8	700	708
				late Nauplius larvae	1	160			
				Brachionus sp.	1	10			
		Ⅰ-C1-SP2-E/a	1	*Oithona* sp.	4	520	7	690	697
				late Nauplius larvae	1	170			
				Brachionus sp.	2				

Analyst 刘萍 Proofreader 李瑞青

Appendix 3. Results for oaganisms(＞50μm) of the Land-based Testing of Cyeco^{TM}-BWMS（>32PSU）

Sampling date	Test run	Sample number	Filter volume(m^3)	Dominant Species	Aalive density（ind.·m^{-3}）	Dead density（ind.·m^{-3}）	Total alive density（ind.·m^{-3}）	Total dead density（ind.·m^{-3}）	Total density（ind.·m^{-3}）
2011.08.04	Effluent water of the 1st test run (Treatment tank)	Ⅰ-C1-SP3-B/a	1	*Oithona sp.*		1	No alive organisms	8	
				late Nauplius larvae		1			
				Brachionus sp.		2			
				Harpacticoida sp.		1			
				Acartia sp.		1			
				Cladocera		1			
				Protozoa		2			
		Ⅰ-C1-SP3-M/a	1	*Oithona* sp.		7	No alive organisms	10	
				late Nauplius larvae		1			
				Brachionus sp.		1			
				Cladocera		1			
		Ⅰ-C1-SP3-E/a	1	Harpacticoida sp.			No alive organisms	10	
				Oithona sp.		4			
				late Nauplius larvae		1			
				Brachionus sp.		2			
				Protozoa		3			
	Effluent water of the 1st test run (Control tank)	Ⅰ-C1-SP4-B/a	1	*Oithona* sp.	16220		$2.0*10^4$		$2.0*10^4$
				late Nauplius larvae	3620				
				Brachionus egg	500				
				Protozoa	60				
		Ⅰ-C1-SP4-M/a	1	*Oithona* sp.	18160		$2.7*10^4$		$2.7*10^4$
				late Nauplius larvae	8340				
				Brachionus sp.	2				
				Brachionus egg	520				
				Protozoa	5				
		Ⅰ-C1-SP4-E/a	1	*Oithona* sp.	13120		$2.1*10^4$		$2.1*10^4$
				late Nauplius larvae	8180				
				Brachionus sp.	40				
				Brachionus egg	420				
				Protozoa	80				
				Harpacticoida sp.	20				

Analyst 孙萍 Proofreader 李瑞

Appendix 3. Results for oaganisms(＞50μm) of the Land-based Testing of Cyeco^{TM}-BWMS（>32PSU）

Sampling date	Test run	Sample number	Filter volume(m^3)	Dominant Species	Aalive density（ind.·m^{-3}）	Dead density（ind.·m^{-3}）	Total alive density（ind.·m^{-3}）	Total dead density（ind.·m^{-3}）	Total density（ind.·m^{-3}）
2011.07.31	Influent water of the 2nd test run	Ⅰ-C2-SP1-B/a	0.02	*Oithona* sp.	56000		$1.01*10^5$		$1.01*10^5$
				late Nauplius larvae	29000				
				Brachionus sp.	15000				
				Paracalanus parvus	50				
				Acartia sp.	1000				
				Nematoda	50				
		Ⅰ-C2-SP1-M/a	0.02	*Oithona* sp.	53000		$1.01*10^5$		$1.01*10^5$
				late Nauplius larvae	27000				
				Brachionus sp.	20000				
				Acartia sp.	100				
				Polychaeta larvae	1000				
				jellyfish larvae	50				
		Ⅰ-C2-SP1-E/a	0.02	*Oithona* sp.	59000		$1.00*10^5$		$1.00*10^5$
				late Nauplius larvae	18000				
				Brachionus sp.	17000				
				Acartia sp.	2000				
				Protozoa	4000				
				Paracalanus parvus	100				
				Harpacticoida sp.	50				
				Polychaeta larvae	50				
	Treated water of the 2nd test run at intake	Ⅰ-C2-SP2-B/a	1	Oithona sp.	6	140	7	174	181
				Nematoda	1				
				late Nauplius larva		30			
				Acartia sp.		3			
				Oikopleura sp.		1			
		Ⅰ-C2-SP2-M/a	1	*Oithona* sp.	4	170	8	220	228
				late Nauplius larvae	2	30			
				Brachionus sp.	2	10			
				Acartia sp.		10			
		Ⅰ-C2-SP2-E/a	1	*Oithona* sp.	4	80	6	240	246
				late Nauplius larvae	1	140			
				Brachionus sp.	1	20			

Analyst 刘萍 Proofreader 李端青

Appendix 3. Results for oaganisms(＞50μm) of the Land-based Testing of Cyeco™-BWMS（>32PSU）

Sampling date	Test run	Sample number	Filter volume(m^3)	Dominant Species	Aalive density（ind.·m^{-3}）	Dead density（ind.·m^{-3}）	Total alive density（ind.·m^{-3}）	Total dead density（ind.·m^{-3}）	Total density（ind.·m^{-3}）
2011.08.05	Effluent water of the 2nd test run (Treatment tank)	Ⅰ-C2-SP3-B/a	1	*Oithona* sp.		160	No alive organisms	514	514
				late Nauplius larvae		20			
				Cladocera		2			
				Brachionus sp.		310			
				Harpacticoida sp.		1			
				Protozoa		10			
				Nematoda		1			
				jellyfish larvae		10			
		Ⅰ-C2-SP3-M/a	1	*Oithona* sp.		160	No alive organisms	260	260
				late Nauplius larvae		10			
				Brachionus sp.		50			
				Protozoa		30			
				Harpacticoida sp.		10			
		Ⅰ-C2-SP3-E/a	1	*Oithona sp.*		50	No alive organisms	90	90
				Harpacticoida sp.		10			
				Brachionus sp.		10			
				Protozoa		20			
	Effluent water of the 2nd test run (Control tank)	Ⅰ-C2-SP4-B/a	1	*Oithona* sp.	68380		$9.1*10^4$		$9.1*10^4$
				late Nauplius larvae	22920				
				Brachionus sp.	380				
				Protozoa	160				
				Harpacticoida sp.	120				
		Ⅰ-C2-SP4-M/a	1	*Oithona* sp.	65440		$1.1*10^5$		$1.1*10^5$
				late Nauplius larvae	46420				
				Brachionus sp.	420				
				Protozoa	180				
				Harpacticoida sp.	100				
		Ⅰ-C2-SP4-E/a	1	*Oithona* sp.	54740		$7.2*10^4$		$7.2*10^4$
				late Nauplius larvae	16960				
				Brachionus sp.	600				
				Protozoa	240				
				Harpacticoida sp.	60				

Analyst 刘萍 Proofreader 李瑞青

Appendix 3. Results for oaganisms(＞50μm) of the Land-based Testing of Cyeco™-BWMS（>32PSU）

Sampling date	Test run	Sample number	Filter volume(m^3)	Dominant Species	Aalive density（ind.·m^{-3}）	Dead density（ind.·m^{-3}）	Total alive density（ind.·m^{-3}）	Total dead density（ind.·m^{-3}）	Total density（ind.·m^{-3}）
2011.08.13	Influent water of the 3rd test run	Ⅰ-C3-SP1-B/a	0.02	*Oithona* sp.	218000		$5.6*10^5$		$5.6*10^5$
				late Nauplius larvae	60000				
				Cladocera	500				
				Brachionus sp.	157500				
				Harpacticoida sp.	500				
				Protozoa	122000				
				paracalanus parvus	1500				
				Nematoda	1500				
		Ⅰ-C3-SP1-M/a	0.02	*Oithona* sp.	216000		$7.2*10^5$		$7.2*10^5$
				late Nauplius larvae	90000				
				Acartia sp.	500				
				Brachionus sp.	284000				
				Harpacticoida sp.	500				
				Protozoa	124000				
				paracalanus parvus	500				
				Nematoda	4500				
		Ⅰ-C3-SP1-E/a	0.02	*Oithona* sp.	210000		$7.1*10^5$		$7.1*10^5$
				late Nauplius larvae	90000				
				Brachionus sp.	256000				
				Protozoa	154000				
				paracalanus parvus	1000				
				Nematoda	3000				
	Treated water of the 3rd test run at intake	Ⅰ-C3-SP2-B/a	1	*Oithona* sp.	4	1050	9	2320	2329
				late Nauplius larvae	2	220			
				paracalanus parvus	1	10			
				Nematoda	2	160			
				Brachionus sp.		480			
				Acartia sp.		40			
				Protozoa		360			

Analyst 刘萍 Proofreader 李瑞青

Appendix 3. Results for oaganisms(>50μm) of the Land-based Testing of Cyeco™-BWMS (>32PSU)

Sampling date	Test run	Sample number	Filter volume(m^3)	Dominant Species	Aalive density (ind.·m^{-3})	Dead density (ind.·m^{-3})	Total alive density (ind.·m^{-3})	Total dead density (ind.·m^{-3})	Total density (ind.·m^{-3})
2011.08.13	Treated water of the 3rd test run at intake	Ⅰ-C3-SP2-M/a	1	*Oithona* sp.	3	1260	10	2950	2960
				late Nauplius larvae	3	420			
				paracalanus parvus	1				
				Nematoda	1	140			
				Brachionus sp.	2	900			
				Protozoa		220			
				Harpacticoida sp.		10			
		Ⅰ-C3-SP2-E/a	1	*Oithona* sp.	4	1630	8	3970	3980
				late Nauplius larvae	3	460			
				Nematoda	1	30			
				Brachionus sp.		1260			
				Protozoa		570			
				paracalanus parvus		20			
2011.08.18	Effluent water of the 3rd test run (Treatment tank)	Ⅰ-C3-SP3-B/a	1	*Oithona* sp.		7	No alive organisms	7	
		Ⅰ-C3-SP3-M/a	1	*Oithona* sp.		7	No alive organisms	7	
		Ⅰ-C3-SP3-E/a	1	*Oithona* sp.		9	No alive organisms	9	
	Effluent water of the 3rd test run (Control tank)	Ⅰ-C3-SP4-B/a	1	late Nauplius larvae	7600	7862			7862
				Harpacticoida *sp.*	260				
				Polychaeta larvae	1				
				Oithona sp.	1				
		Ⅰ-C3-SP4-M/a	1	late Nauplius larvae	6520	6927			6927
				Harpacticoida sp.	380				
				Brachionus sp.	7				
				Oithona sp.	20				
		Ⅰ-C3-SP4-E/a	1	late Nauplius larvae	9180	$1.0*10^4$			$1.0*10^4$
				Brachionus sp.	920				
				Harpacticoida sp.	60				
				Acartia sp.	20				
				Polychaeta larvae	1				
				Oithona sp.	1				

Analyst 刘萍 Proofreader 李晓雪

Appendix 3. Results for oaganisms(>50μm) of the Land-based Testing of Cyeco™-BWMS（>32PSU）

Sampling date	Test run	Sample number	FiFilter volume(m^3)	Dominant Species	Aalive density（ind.·m^{-3}）	Dead density（ind.·m^{-3}）	Total alive density（ind.·m^{-3}）	Total dead density（ind.·m^{-3}）	Total density（ind.·m^{-3}）
2011.08.14	Influent water of the 4th test run	Ⅰ-C4-SP1-B/a	0.02	Nauplius larvae	196000	$2.48*10^5$			$2.48*10^5$
				Brachionus sp.	44000				
				Polychaeta larvae	4000				
				Nematoda	3800				
				Oithona sp.	100				
		Ⅰ-C4-SP1-M/a	0.02	late Nauplius larvae	178000	$1.96*10^5$			$1.96*10^5$
				Brachionus sp.	10000				
				Paracalanus parvus	8000				
				Oithona sp.	100				
		Ⅰ-C4-SP1-E/a	0.02	*late Nauplius larvae*	205000	$2.25*10^5$			$2.25*10^5$
				Brachionus sp.	15000				
				Protozoa	5000				
				Nematoda	100				
				late Nauplius larva	50				
	Treated water of the 4th test run at intake	Ⅰ-C4-SP2-B/a	1	Nematoda	1	160	5	12160	12165
				Oithona sp.	4	80			
				Brachionus sp.		330			
				Protozoa		11250			
				Oithona sp.		340			
		Ⅰ-C4-SP2-M/a	1	*Brachionus sp.*	1	50	3	11110	11113
				late Nauplius larva	2	10620			
				Protozoa		140			
				Nematoda		260			
				Brachionus sp.		40			
		Ⅰ-C4-SP2-E/a	1	*Oithona* sp.	3	12380	3	12995	12998
				late Nauplius larva		15			
				Protozoa		20			
				Nematoda		460			
				Oithona sp.		120			

Analyst 孙萍 Proofreader 李炳哲

Appendix 3. Results for oaganisms(>50μm) of the Land-based Testing of Cyeco^{TM}-BWMS（>32PSU）

Sampling date	Test run	Sample number	Filter volume(m^3)	Dominant Species	Aalive density（ind.·m^{-3}）	Dead density（ind.·m^{-3}）	Total alive density（ind.·m^{-3}）	Total dead density（ind.·m^{-3}）	Total density（ind.·m^{-3}）
2011.08.19	Effluent water of the 4th test run (Treatment tank)	Ⅰ-C4-SP3-B/a	1	*Oithona* sp.		52	No alive organisms	52	
		Ⅰ-C4-SP3-M/a	1	*Oithona* sp.		51	No alive organisms	51	
		Ⅰ-C4-SP3-E/a	1	*Oithona* sp.		63	No alive organisms	63	
2011.08.19	Effluent water of the 4th test run (Control tank)	Ⅰ-C4-SP4-B/a	1	late Nauplius larvae	75750	$7.8*10^4$			$7.8*10^4$
				Brachionus sp.	3000				
				Corycaeus affinis	7				
				Polychaeta larvae	4				
				Oithona sp.	32				
		Ⅰ-C4-SP4-M/a	1	late Nauplius larvae	40800	$4.2*10^4$			$4.2*10^4$
				Corycaeus affinis	1050				
				Polychaeta larvae	2				
				Oithona sp.	150				
		Ⅰ-C4-SP4-E/a	1	late Nauplius larvae	19800	$2.1*10^4$			$2.1*10^4$
				Brachionus sp.	1800				
				Corycaeus affinis	1				
				Polychaeta larvae	6				
				Oithona sp.	7				
2011.08.20	Influent water of the 5th test run	Ⅰ-C5-SP1-B/a	0.02	late Nauplius larvae	132000	$1.65*10^5$			$1.65*10^5$
				Brachionus sp.	32000				
				Acartia sp.	150				
				Paracalanus parvus	350				
				Corycaeus affinis	100				
				Polychaeta larvae	50				
				Oithona sp.	100				
		Ⅰ-C5-SP1-M/a	0.02	late Nauplius larvae	112000	$1.51*10^5$			$1.51*10^5$
				Brachionus sp.	38000				
				Acartia sp.	100				
				Paracalanus parvus	1000				
				Protozoa	50				
				Oithona sp.	150				

Analyst 刘萍 Proofreader 李福贵

Appendix 3. Results for oaganisms(>50μm) of the Land-based Testing of Cyeco™-BWMS（>32PSU）

Sampling date	Test run	Sample number	Filter volume(m^3)	Dominant Species	Aalive density（ind.·m^{-3}）	Dead density（ind.·m^{-3}）	Total alive density（ind.·m^{-3}）	Total dead density（ind.·m^{-3}）	Total density（ind.·m^{-3}）
2011.08.20	Influent water of the 5th test run	Ⅰ-C5-SP1-E/a	0.02	late Nauplius larvae	114000	$1.58*10^5$			$1.58*10^5$
				Coscinodiscus spp.	43000				
				Lamellibranchia larvae	100				
				Protozoa	50				
				Polychaeta larvae	450				
				Oithona sp.	50				
2011.08.20	Treated water of the 5th test run at intake	Ⅰ-C5-SP2-B/a	1	Nematoda	4	201	5	201	211
				Oithona sp.	1				
		Ⅰ-C5-SP2-M/a	1	*Oithona* sp.	4	205	4	205	209
		Ⅰ-C5-SP2-E/a	1	*Oithona* sp.		61		61	61
2011.08.25	Effluent water of the 5th test run (Treatment tank)	Ⅰ-C5-SP3-B/a	1	late Nauplius larvae		22	No alive organisms	23	24
				Oithona sp.		1			
		Ⅰ-C5-SP3-M/a	1	*Oithona* sp.		12	No alive organisms	12	13
		Ⅰ-C5-SP3-E/a	1	late Nauplius larvae		12	No alive organisms	16	17
				Oithona sp.		4			
	Effluent water of the 5th test run (Control tank)	Ⅰ-C5-SP4-B/a	1	late Nauplius larvae	60900	$7.0*10^4$			$7.0*10^4$
				Lamellibranchia larvae	9100				
				Harpacticoida sp.	12				
				Ciliophora	2				
				Oithona sp.	1				
		Ⅰ-C5-SP4-M/a	1	late Nauplius larvae	37700	$4.2*10^4$			$4.2*10^4$
				Lamellibranchia larvae	4700				
				Ciliophora	6				
				Oithona sp.	1				
		Ⅰ-C5-SP4-E/a	1	late Nauplius larvae	49600	$6.6*10^4$			$6.6*10^4$
				Lamellibranchia larvae	17100				
				Polychaeta larvae	2				
				Corycaeus affinis	4				
				Oithona sp.	1				

Analyst 刘萍 Proofreader 李瑞青

Appendix 4. Results for oaganisms(>50μm) of the Land-based Testing of Cyeco™-BWMS（3-22PSU）

Sampling date	Test run	Sampling number	Filter volume (m^3)	Dominant Species	Alive density (ind.·m^{-3})	Dead density (ind.·m^{-3})	Total alive density (ind.·m^{-3})	Total dead density (ind.·m^{-3})	Total density (ind.·m^{-3})
2011.08.21	Influent water of the 1st test run	II-C1-SP1-B/a	0.02	*Oithona* sp.	54000				$1.05*10^5$
				late Nauplius larvae	25500				
				Brachionus sp.	19500				
				Polychaeta larvae	50				
				Nematoda	3000				
				Lamellibranchia larvae	1500				
				Copepoda larvea	1500				
				Ciliophora	50				
		II-C1-SP1-M/a	0.02	*Oithona* sp.	78000				$1.02*10^5$
				late Nauplius larvae	7000				
				Brachionus sp.	15000				
				Acartia sp.	1000				
				Ciliophora	1000				
				Paracalanus parvus	100				
		II-C1-SP1-E/a	0.02	*Oithona sp.*	82000				$1.06*10^5$
				late Nauplius larvae	8000				
				Brachionus sp.	11000				
				Acartia sp.	1000				
				Ciliophora	3000				
				Lamellibranchia larvae	1000				
	Treated water of the 1st test run at intake	II-C1-SP2-B/a	1	*Oithona sp.*	2	9	2	9	11
		II-C1-SP2-M/a	1	No alive organisms	0	0	0	0	0
		II-C1-SP2-E/a	1	No alive organisms	0		0	1	1
				Oithona sp.		1			
2011.08.26	Effluent water of the 1st test run (Treatment tank)	II-C1-SP3-B/a	1	*Oithona sp.*	No alive organisms	336	No alive organisms	354	
				late Nauplius larvae		17			
				Lamellibranchia larvae		1			
		II-C1-SP3-M/a	1	*Oithona sp.*	No alive organisms	97	No alive organisms	110	
				late Nauplius larvae		13			
		II-C1-SP3-E/a	1	*Oithona sp.*	No alive organisms	83	No alive organisms	95	
				late Nauplius larvae		12			

Analyst 刘萍 Proofreader 李瑞雪

Appendix 4. Results for oaganisms(>50μm) of the Land-based Testing of Cyeco™-BWMS（3-22PSU）

Sampling date	Low salinity (>3~22psu)	Sampling number	Filter volume (m^3)	Dominant Species	Alive density (ind.·m^{-3})	Dead density (ind.·m^{-3})	Total alive density (ind.·m^{-3})	Total dead density (ind.·m^{-3})	Total density (ind.·m^{-3})
2011.08.26	Effluent water of the 1st test run (Control tank)	II-C1-SP4-B/a	1	*Oithona* sp.	15600				$3.1*10^4$
				late Nauplius larvae	13400				
				Brachionus sp.	2300				
				Polychaeta larvae	1				
				Nematoda	1				
		II-C1-SP4-M/a	1	*Oithona* sp.	12000				$2.7*10^4$
				late Nauplius larvae	12800				
				Brachionus sp.	2900				
				Polychaeta larvae	1				
				Harpacticoida sp.	1				
		II-C1-SP4-E/a	1	*Oithona* sp.	12600				$3.3*10^4$
				late Nauplius larvae	17700				
				Brachionus sp.	2900				
				Polychaeta larvae	1				
				Cyclopoidea sp.	700				
2011.08.27	Influent water of the 2nd test run	II-C2-SP1-B/a	0.02	*Oithona* sp.	185000				2.3*105
				late Nauplius larvae	40000				
				Brachionus sp.	5000				
				Protozoa	5000				
				Nematoda.	50				
		II-C2-SP1-M/a	0.02	*Oithona sp.*	285000				$2.9*10^5$
				late Nauplius larvae	5000				
				Brachionus sp.	5000				
				Harpacticoida sp.	50				
				Nematoda	50				
				Lamellibranchia larvae	50				
		II-C2-SP1-E/a	0.02	*Oithona* sp.	220000				$2.7*10^5$
				late Nauplius larvae	50000				
				Brachionus sp.	5000				
				Protozoa	150				
				Polychaeta larvae	50				

Analyst 刘萍 Proofreader 李瑞青

Appendix 4. Results for oaganisms(>50μm) of the Land-based Testing of Cyeco™-BWMS（3-22PSU）

Sampling date	Low salinity (>3~22psu)	Sampling number	Filter volume (m^3)	Dominant Species	Alive density (ind.·m^{-3})	Dead density (ind.·m^{-3})	Total alive density (ind.·m^{-3})	Total dead density (ind.·m^{-3})	Total density (ind.·m^{-3})
2011.08.27	Treated water of the 2nd test run at intake	II-C2-SP2-B/a	1	*Oithona* sp.	5	9	5	9	14
		II-C2-SP2-M/a	1	*Oithona* sp.	2	2	3	3	6
				Nematoda	1				
				Cyclopoidea sp.		1			
		II-C2-SP2-E/a	1	*Oithona* sp.		4	0	5	5
				late Nauplius larvae		1			
2011.09.01	Effluent water of the 2nd test run (Treatment tank)	II-C2-SP3-B/a	1	*Oithona sp.*		2		2	2
		II-C2-SP3-M/a	1	*Oithona sp.*		3		3	3
		II-C2-SP3-E/a	1	*Oithona sp.*		4		7	7
				late Nauplius larvae		3			
	Effluent water of the 2nd test run (Control tank)	II-C2-SP4-B/a	1	*Oithona* sp.	9900				$1.0*10^4$
				late Nauplius larvae	500				
				Brachionus sp.	15				
		II-C2-SP4-M/a	1	*Oithona* sp.	4000				5000
				late Nauplius larvae	800				
				Brachionus sp.	200				
		II-C2-SP4-E/a	1	*Oithona* sp.	6500				7600
				late Nauplius larvae	1000				
				Brachionus sp.	100				
2011.08.28	Influent water of the 3rd test run	II-C3-SP1-B/a	0.02	*Oithona* sp.	220000				$2.7*10^5$
				late Nauplius larvae	45000				
				Brachionus sp.	5000				
				Polychaeta larvae	5000				
				Nematoda	100				
		II-C3-SP1-M/a	0.02	*Oithona* sp.	165000				$1.8*10^5$
				late Nauplius larvae	10000				
				Brachionus sp.	10000				
				Protozoa	100				
				Nematoda	50				

Analyst 刘萍 Proofreader 李晓春

Appendix 4. Results for oaganisms(>50μm) of the Land-based Testing of Cyeco™-BWMS（3-22PSU）

Sampling date	Low salinity (>3~22psu)	Sampling number	Filter volume (m^3)	Dominant Species	Alive density (ind.·m^{-3})	Dead density (ind.·m^{-3})	Total alive density (ind.·m^{-3})	Total dead density (ind.·m^{-3})	Total density (ind.·m^{-3})
2011.08.28	Influent water of the 3rd test run	II-C3-SP1-E/a	0.02	*Oithona* sp.	225000				$2.4*10^5$
				late Nauplius larvae	15000				
				Brachionus sp.	5000				
				Harpacticoida sp.	100				
				Nematoda	50				
2011.08.28	Treated water of the 3rd test run at intake	II-C3-SP2-B/a	1	*Oithona* sp.	4	10	4	10	14
		II-C3-SP2-M/a	1	*Ciliophora*	1		1	1	2
				Oithona sp.		1			
		II-C3-SP2-E/a	1	Nematoda	3		3	3	6
				Oithona sp.		3			
2011.09.02	Effluent water of the 3rd test run (Treatment tank)	II-C3-SP3-B/a	1	*Oithona* sp.		38	No alive organisms	112	
				late Nauplius larvae		74			
		II-C3-SP3-M/a	1	*Oithona* sp.		41	No alive organisms	213	
				late Nauplius larvae		172			
		II-C3-SP3-E/a	1	*Oithona* sp.		20	No alive organisms	109	
				late Nauplius larvae		89			
	Effluent water of the 3rd test run (Control tank)	II-C3-SP4-B/a	1	*Oithona* sp.	31400				$1.1*10^5$
				late Nauplius larvae	77400				
				Cyclopoidea sp.	500				
				Brachionus sp.	900				
		II-C3-SP4-M/a	1	*Oithona* sp.	14500				$7.8*10^4$
				late Nauplius larvae	61200				
				Cyclopoidea sp.	1200				
				Brachionus sp.	1100				
		II-C3-SP4-E/a	1	*Oithona* sp.	18500				$7.5*10^4$
				late Nauplius larvae	55100				
				Cyclopoidea sp.	1200				
				Brachionus sp.	300				

Analyst 刘萍 Proofreader 李瑞青

Appendix 4. Results for oaganisms(>50μm) of the Land-based Testing of Cyeco™-BWMS（3-22PSU）

Sampling date	Low salinity (>3~22psu)	Sampling number	Filter volume (m^3)	Dominant Species	Alive density (ind.·m^{-3})	Dead density (ind.·m^{-3})	Total alive density (ind.·m^{-3})	Total dead density (ind.·m^{-3})	Total density (ind.·m^{-3})
2011.09.03	Influent water of the 4th test run	II-C4-SP1-B/a	0.02	*Oithona* sp.	390000				$2.2*10^6$
				late Nauplius larvae	155000				
				Cyclopoidea sp.	650				
				Brachionus sp.	90000				
				Protozoa	1595000				
		II-C4-SP1-M/a	0.02	*Oithona* sp.	410000				$2.8*10^6$
				late Nauplius larvae	250000				
				Cyclopoidea sp.	5000				
				Brachionus sp.	295000				
				Protozoa	1875000				
		II-C4-SP1-E/a	0.02	*Oithona* sp.	345000				$2.0*10^6$
				late Nauplius larvae	235000				
				Cyclopoidea sp.	5000				
				Brachionus sp.	355000				
				Protozoa	1060000				
2011.09.03	Treated water of the 4th test run at intake	II-C4-SP2-B/a	1	*Oithona* sp.		2		2	2
		II-C4-SP2-M/a	1	Nematoda	1		1	0	1
		II-C4-SP2-E/a	1	No organisms	0		0	0	0
2011.09.08	Effluent water of the 4th test run (Treatment tank)	II-C4-SP3-B/a	1	*Oithona* sp.		37	No alive organisms	44	
				late Nauplius larvae		7			
		II-C4-SP3-M/a	1	*Oithona* sp.		36	No alive organisms	52	
				late Nauplius larvae		16			
		II-C4-SP3-E/a	1	*Oithona* sp.		17	No alive organisms	23	
				late Nauplius larvae		6			

Analyst 刘萍 Proofreader 李瑞青

Appendix 4. Results for oaganisms(>50μm) of the Land-based Testing of Cyeco™-BWMS（3-22PSU）

Sampling date	Low salinity (>3~22psu)	Sampling number	Filter volume (m^3)	Dominant Species	Alive density (ind.·m^{-3})	Dead density (ind.·m^{-3})	Total alive density (ind.·m^{-3})	Total dead density (ind.·m^{-3})	Total density (ind.·m^{-3})
2011.09.08	Effluent water of the 4th test run (Control tank)	II-C4-SP4-B/a	1	*Oithona* sp.	26500				$4.5*10^4$
				late Nauplius larvae	7100				
				Brachionus sp.	11600				
		II-C4-SP4-M/a	1	*Oithona* sp.	24300				$4.3*10^4$
				late Nauplius larvae	7400				
				Brachionus sp.	11800				
		II-C4-SP4-E/a	1	*Oithona* sp.	19500				$3.0*10^4$
				late Nauplius larvae	4100				
				Brachionus sp.	6500				
2011.09.04	Influent water of the 5th test run	II-C5-SP1-B/a	0.02	*Oithona* sp.	240000				$6.0*10^5$
				late Nauplius larvae	120000				
				Brachionus sp.	40000				
				Protozoa	205000				
				Paracalanus parvus	50				
				Polychaeta larvae	100				
		II-C5-SP1-M/a	0.02	*Oithona* sp.	320000				$6.8*10^5$
				late Nauplius larvae	125000				
				Brachionus sp.	25000				
				Protozoa	215000				
				Polychaeta larvae	50				
		II-C5-SP1-E/a	0.02	*Oithona* sp.	285000				$8.9*10^5$
				late Nauplius larvae	70000				
				Brachionus sp.	45000				
				Protozoa	490000				
	Treated water of the 5th test run at intake	II-C5-SP2-B/a	1	*Oithona* sp.	3	6	3	7	10
				Brachionus sp.		1			
		II-C5-SP2-M/a	1	*Oithona* sp.	7	6	11	68	79
				Brachionus sp.	4	62			
		II-C5-SP2-E/a	1	*Oithona* sp.	2	2	7	73	80
				Brachionus sp.	5	71			

Analyst 孙萍 Proofreader 李瑞香

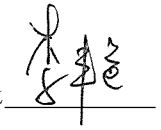
Appendix 4. Results for oaganisms(>50μm) of the Land-based Testing of Cyeco^{TM}-BWMS（3-22PSU）

Sampling date	Low salinity (>3~22psu)	Sampling number	Filter volume (m^3)	Dominant Species	Alive density (ind.·m^{-3})	Dead density (ind.·m^{-3})	Total alive density (ind.·m^{-3})	Total dead density (ind.·m^{-3})	Total density (ind.·m^{-3})
2011.09.09	Effluent water of the 5th test run (Treatment tank)	II-C5-SP3-B/a	1	*Oithona* sp.		88	No alive organisms	119	
				late Nauplius larvae		25			
				Brachionus sp.		6			
		II-C5-SP3-M/a	1	*Oithona* sp.		89	No alive organisms	103	
				late Nauplius larvae		11			
				Brachionus sp.		3			
		II-C5-SP3-E/a	1	*Oithona* sp.		39	No alive organisms	55	
				late Nauplius larvae		16			
				Brachionus sp.					
	Effluent water of the 5th test run (Control tank)	II-C5-SP4-B/a	1	*Oithona* sp.	159800				$5.8*10^5$
				late Nauplius larvae	60000				
				Brachionus sp.	360000				
				Polychaeta larvae	200				
		II-C5-SP4-M/a	1	*Oithona* sp.	170000				$7.0*10^5$
				late Nauplius larvae	190000				
				Brachionus sp.	340000				
		II-C5-SP4-E/a	1	*Oithona* sp.	190000				$1.1*10^6$
				late Nauplius larvae	140000				
				Brachionus sp.	780000				

Analyst 刘萍 Proofreader 李瑞雪

Appendix 5. Results for organisms(10—50μm) of the Land-based Testing of Cyeco™-BWMS（>32PSU）

Sampling date	Test run	Sample number	Filter volume（L）	Condense volume（ml）	Dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.07.30	Influent water of the 1st test run	I-C1-SP1-B/b	1	100	Diatom	*coscinodiscus spp.*	1.5	1191.50		
						Chaetoceros spp.	16.33			
						skeletonema costatum	25.5			
						Thalassiosira rotula	0.67			
						Nitzschia spp.	0.17			
						Pinnularia spp.	0.17			
					Chlorophyta	*Platymonas helgolandica*	178.83			
					Dinofllagelate	*Scrippsiella trochoidea*	0.17			
					Chrysophyta	*Isochrysis spp.*	966.67			
					Protozoa	*protozoa*	0.17			
					others		1.33			
		I-C1-SP1-M/b	1	104	Diatom	*skeletonema costatum*	50.96	1485.12		
						Chaetoceros spp.	17.33			
						coscinodiscus spp.	0.17			
						Nitzschia spp.	0.17			
						Nitzschia closterium	1.56			
					Protozoa	*protozoa*	1.21			
					Dinofllagelate	*Scrippsiella trochoidea*	0.52			
						Cysts	0.69			
					Chlorophyta	*Platymonas helgolandica*	105.56			
					Chrysophyta	*Isochrysis spp.*	1307			
		I-C1-SP1-E/b	1	72	Diatom	*Skeletonema costatum*	51.84	1105.44		
						Nitzschia closteritum	1.08			
						Ditylum brightwelli	0.12			
						Chaetoceros spp.	14.88			
						coscinodiscus spp.	0.24			
					Dinafllagelate	*Scrippsiella trochoidea*	0.12			
					Chlorophyta	*Platymonas helgolandica*	118.32			
					Chrysophyta	*Isochrysis spp.*	918.72			
					Cysts	*Cysts*	0.12			
					Protozoa	*protozoa*	2.04			

Analyst  Proofreader 

Appendix 5. Results for organisms(10—50μm) of the Land-based Testing of Cyeco^{TM}-BWMS（>32PSU）

Sampling date	High salinity (>32psu)	Sample number	Filter volume （L）	Condense volume（ml）	Dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.07.31	Treated water of the 1st test run at intake	I-C1-SP2-B/b	10	56	Chrysophyta	*Isochrusis galbana*	0.019	0.047	92.12	102.19
					Chlorophyta	*Platymanas helgolandica*	0.019		8.72	
					Diatom	*Skeletonema costatum*	no alive cells		1.33	
						Thalassiosira sp.	no alive cells		0.02	
					Dinofllagelate	*Gymnodinium sp.*	0.009		0.01	
2011.07.31		I-C1-SP2-M/b	10	44	Chrysophyta	*Isochrusis galbana*	0.015	0.022	75.80	82.10
					Chlorophyta	*Platymanas helgolandica*	0.007		5.34	
					Diatom	*Chaetoceros sp.*	no alive cells		0.18	
						Skeletonema costatum	no alive cells		0.79	
		I-C1-SP2-E/b	10	45	Diatom	Paralia sulcata	no alive cells	0.015	0.48	91.32
						Skeletonema costatum	no alive cells		2.01	
					Chrysophyta	*Isochrusis galbana*	0.015		82.56	
					Chlorophyta	*Platymanas helgolandica*	no alive cells		5.85	
					Others		no alive cells		0.42	
2011.08.04	Effluent water in treated tank of the 1st test run at	I-C1-SP3-B/b	10	88		no alive cells				
		I-C1-SP3-M/b	10	92		no alive cells				
		I-C1-SP3-E/b	10	95		no alive cells				
2011.08.04	Effluent water in reference tank of the 1st test run at discharge	I-C1-SP4-B/b	10	104	Diatom	*Skeletonema costatum*	4.18	108.71		
						Nitischia closterum	0.09			
						Thalasstosira rotula	0.14			
					Chrysophyta	*Isochrusis galbana*	81.41			
					Chlorophyta	*Platymonas helgolandica*	22.90			
		I-C1-SP4-M/b	10	102	Diatom	*Skeletonema costatum*	1.84	114.55		
						Nitzschia closterum	0.07			
						Thalassiosira rotula	0.03			
					Chloropyta	*Platymonas helgolandica*	18.85			
					Chrysophyta	*Isochrusis galbana*	91.58			
					others		2.18			
		I-C1-SP4-E/b	10	110	Diatom	*Skeletonema costatum*	5.56	118.65		
						Chaetoceros spp.	4.79			
					Chlorophyta	*Platymonas helgolandica*	14.26			
					Chrysophyta	*Isochrysis galbana*	86.50			
					Protozoa	*Protozoa*	1.52			
					others		6.03			

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Appendix 5. Results for organisms(10—50μm) of the Land-based Testing of Cyeco™-BWMS（>32PSU）

Sampling date	High salinity (>32psu)	Sample number	Filter volume (L)	Condense volume (ml)	Dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.07.31	Influent water of the 2nd test run	I-C2-SP1-B/b	1	76	Diatom	*Skeletonema costatum*	11.15	1340.01		
						Chaetoceros spp.	5.83			
						Leptocylindrus danicus	0.25			
						coscinodiscus spp.	1.27			
						Nitzschia closterium	0.38			
						Thalassiosira rotula	0.25			
					Dinofllagelate	*Scrippsiella trochoidea*	0.13			
			1	76	Chlorophyta	*Platymonas helgolandica*	168.97			
					Chrysophyta	*Isochrysis galbana*	1146.08			
					Protozoa	*protozoa*	5.7			
		I-C2-SP1-M/b	1	75	Diatom	*Nitzschia closterium*	1.125	1169.00		
						Skeletonema costatum	14.875			
						Pinnularia spp.	0.125			
						Thalassiosira rotula	0.125			
						Pleurasigma spp.	0.125			
						Navicula spp.	0.125			
						Chaetoceros spp.	5.5			
						coscinodiscus spp.	0.5			
					Dinofllagelate	*Scrippsiella trochoidea*	0.625			
					Chlorophyta	*Platymonas helgolandica*	126.875			
					Chrysophyta	*Isochrysis galbana*	1015			
					Protozoa	*protozoa*	4			
		I-C2-SP1-E/b	1	104	Diatom	*coscinodiscus spp.*	0.69	1160.81		
						Chaetoceros spp.	6.07			
						Skeletonema costatum	19.24			
						Nitzschia closterum	0.35			
					Dinofllagelate	*Scrippsiella trochoidea*	0.17			
					Chlorophyta	*Platymonas helgolandica*	206.09			
					Chrysophyta	*Isochrysis galbana*	924.91			
					Protozoa	*protozoa*	3.12			
					Cysts	*Dinafllagelate cysts*	0.17			

Analyst 李[illegible]　　Proofreader [illegible]

Appendix 5. Results for organisms(10—50μm) of the Land-based Testing of Cyeco™-BWMS（>32PSU）

Sampling date	High salinity (>32psu)	Sample number	Filter volume (L)	Condense volume (ml)	Dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.07.31	Treated water of the 2nd test run at intake	I-C2-SP2-B/b	10	80	Chryphyta	*Isochrsis galbana*	0. 04	0.066	151.20	167.79
						Dictyocha fibula	no alive cells		0.013	
					Diatom	*Skeletonema costatum*	no alive cells		1.440	
					Chlorophyta	*Platymonas helgolandica*	0. 013		12.027	
					Dinofllagelate	*Protoperidinium bipes*	no alive cells		0.013	
					Protozoa	*protozoa*	0. 013		0.027	
		I-C2-SP2-M/b	10	85	Chryphyta	*Isochrsis galbana*	0. 028	0.042	127.613	140.00
					Chlorophyta	*Platymonas helgolandica*	0. 014		11.163	
					Diatom	*Skeletonema costatum*	no alive cells		1.190	
						Nitzschia sp.	no alive cells		0.028	
		I-C2-SP2-E/b	10	92	Diatom	*Skeletonema costatum*	no alive cells		1.69	164.85
						Chaetoceros spp.	no alive cells		0.21	
						Pleurasigma spp.	no alive cells		0.03	
					Dinofllagelate	*Protoperidinium bipes*	no alive cells	0.077	0.02	
					Chrysophyta	*Isochrusis galbana*	0.046		146.40	
					Chlorophyta	*Platymanas helgolandica*	0.015		15.64	
					others		0.015		0.86	
2011.08.05	Effluent water in treated tank of the 2nd test run at discharge	I-C2-SP3-B/b	10	84	Diatom	*Thalassiosira rotula*	no alive cells	0.015	0.028	98.73
						Pleurasigma spp.	no alive cells		0.014	
					Chrysophyta	*Isochrusis galbana*	no alive cells		90.356	
					Chlorophyta	*Platymanas helgolandica*	no alive cells		8.33	
		I-C2-SP3-M/b	10	90	Chrysophyta	*Isochrusis galbana*	no alive cells		92.708	98.78
					Chlorophyta	*Platymanas helgolandica*	no alive cells		5.614	
					Diatom	*Skeletonema costatum*	no alive cells		0.448	
						Nitzschia sp.	no alive cells		0.014	
		I-C2-SP3-E/b	10	88	Chrysophyta	*Isochrusis galbana*	0.015		98.098	104.41
					Chlorophyta	*Platymanas helgolandica*	no alive cells		5.544	
					Diatom	*Skeletonema costatum*	no alive cells		0.77	

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Appendix 5. Results for organisms(10—50μm) of the Land-based Testing of Cyeco™-BWMS（>32PSU）

Sampling date	High salinity (>32psu)	Sample number	Filter volume (L)	Condense volume (ml)	Dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.08.05	Effluent water in reference tank of the 2nd test run at discharge	I-C2-SP4-B/b	10	96	Diatom	*Nitzschia closterum*	0.13	158.35		
						Amphiprora spp.	0.03			
						Isochrusis galbana	148.66			
					Chrysophyta	*Platymanas helgolandica*	9.22			
					Chlorophyta	*Corallophila spp.*	0.13			
					others		0.19			
		I-C2-SP4-M/b	10	92	Diatom	*coscinodiscus spp.*	0.03	162.99		
						Nitzschia closterum	0.06			
					Dinofllagelate	*Peridinium spp.*	0.03			
					Chrysophyta	*Isochrusis galbana*	160.11			
					Chlorophyta	*Platymanas helgolandica*	2.51			
					others		0.25			
		I-C2-SP4-E/b	10	90	Chlorophyta	*Platymanas helgolandica*	5.18	249.29		
					Chrysophyta	*Isochrusis galbana*	243.57			
					Dinafllagelate	*Peridinium spp.*	0.03			
					Diatom	*Nitzschia closterum*	0.15			
					others		0.36			
2011.08.13	Influent water of the 3rd test run	I-C3-SP1-B/b	1	90	Chrysophyta	*Isochrusis galbana*	556.8	1056.00		
					Chlorophyta	*Platymanas helgolandica*	141.45			
					Diatom	*Sheletonema costatum*	30.15			
						Chaetoceros spp.	8.7			
						Licmophora abbreviata	3.45			
					others		15.6			
		I-C3-SP1-M/b	1	86	Chrysophyta	*Isochrusis galbana*	835.63	1051.64		
					Chlorophyta	*Platymanas helgolandica*	112.09			
					Diatom	*Skeletonema costatum*	39.56			
						Nitzschia closterum	1.72			
						Rhizosolenia delicatula	1.86			
					others		60.77			

Analyst 李[illegible] Proofreader 李[illegible]

Appendix 5. Results for organisms(10—50μm) of the Land-based Testing of Cyeco™-BWMS（>32PSU）

Sampling date	High salinity (>32psu)	Sample number	Filter volume (L)	Condense volume (ml)	Dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.08.13	Influent water of the 3rd test run	I-C3-SP1-E/b	1	108	Chrysophyta	*Isochrusis galbana*	957.60	1302.66		
					Chlorophyta	*Platymanas helgolandica*	187.74			
					Diatom	*Skeletonema costatum*	42.12			
						Chaetoceros spp.	16.74			
					Dinofllagelate	*Peridinium spp.*	1.44			
						Ceratium tripos	1.44			
					others		95.58			
2011.08.13	Treated water of the 3rd test run at intake	I-C3-SP2-B/b	10	100	Chrysophyta	*Isochrusis galbana*	0.02	0.037	107.75	122.27
					Chlorophyta	*Platymanas helgolandica*	no alive cells		7.98	
					Diatom	*Skeletonema costatum*	no alive cells		3.87	
						Paralia sulcata	no alive cells		0.85	
						Ditylum brightwelli	no alive cells		0.12	
					others		0.017		1.70	
		I-C3-SP2-M/b	10	100	Chrysophyta	*Isochrusis galbana*	no alive cells		86.50	107.42
					Chlorophyta	*Platymanas helgolandica*	no alive cells		6.28	
					Diatom	*Skeletonema costatum*	no alive cells		11.83	
					Dinofllagelate	*Gymnodinium sp.*	no alive cells		0.98	
					others		no alive cells		1.82	
		I-C3-SP2-E/b	10	92	Chrysophyta	*Isochrusis galbana*	0.015	0.06	90.47	111.52
					Chlorophyta	*Platymanas helgolandica*	0.015		7.56	
					Diatom	*Skeletonema costatum*	no alive cells		6.12	
						Thalassiosira sp.	no alive cells		1.55	
						Pleurosigma sp.	no alive cells		0.11	
						Cyclotella sp.	no alive cells		0.11	
						Diploneis bombus	no alive cells		0.11	
					Dinofllagelate	*Gymnodinium sp.*	0.015		0.20	
						Gyrodinium sp.	no alive cells		0.20	
						Prorocentrum micans	no alive cells		0.11	
					others		0.015		5.00	

Analyst _____ Proofreader _____

Appendix 5. Results for organisms(10—50μm) of the Land-based Testing of Cyeco™-BWMS（>32PSU）

Sampling date	High salinity (>32psu)	Sample number	Filter volume (L)	Condense volume (ml)	Dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.08.18	Effluent water in treated tank of the 3rd test run at discharge	I-C3-SP3-B/b	10	85	Diatom	*Skeletonema costatum*	no alive cells		0.77	34.41
					Cryptophyta	*Cryptomonas spp.*	no alive cells		0.38	
					Chrysophyta	*Isochrusis galbana*	no alive cells		29.82	
					Chlorophyta	*Platymanas helgolandica*	no alive cells		3.44	
		I-C3-SP3-M/b	10	100	Chrysophyta	*Isochrusis galbana*	no alive cells		28.32	30.25
					Chlorophyta	*Platymanas helgolandica*	no alive cells		1.91	
					Cysts	*Cysts*	no alive cells		0.01	
		I-C3-SP3-E/b	10	80	Chrysophyta	*Isochrusis galbana*	no alive cells		36.37	39.43
					Chlorophyta	*Platymanas helgolandica*	no alive cells		3.03	
					others	*spp.*	no alive cells		0.01	
					Dinofllagelate	*Gonyaulax spp.*	no alive cells		0.01	
2011.08.18	Effluent water in reference tank of the 3rd test run at discharge	I-C3-SP4-B/b	10	85	Diatom	*Thalassiosira rotula*	0.03	101.25		
						coscinodiscus spp.	0.01			
						Skeletonema costatum	0.04			
						Pleurasigma spp.	0.01			
					Dinofllagelate	*Protoperidinium bipes*	0.07			
						Gyrodinium spp.	0.03			
					Cryptophyta	*Cryptomonas spp.*	0.01			
					Chrysophyta	*Isochrusis galbana*	96.67			
					Chlorophyta	*Platymanas helgolandica*	4.05			
					others		0.31			
		I-C3-SP4-M/b	10	120	Diatom	*Thalassiosira rotula*	0.10	117.40		
						Skeletonema costatum	0.06			
					Dinofllagelate	*Dinophysis acuta*	0.02			
						Protoperidinium bipes	0.04			
					Chrysophyta	*Isochrusis galbana*	108.64			
					Chlorophyta	*Platymanas helgolandica*	8.16			
					others		0.38			
		I-C3-SP4-E/b	10		Diatom	*Skeletonema costatum*	0.12			
						Thalassiosira rotula	0.02			
					Dinofllagelate	*Protoperidinium bipes*	0.05			
					Chrysophyta	*Isochrusis galbana*	97.29			
					Chlorophyta	*Platymanas helgolandica*	10.22			
					others		0.75			

Analyst 李静 Proofreader 李晓东

Appendix 5. Results for organisms(10—50μm) of the Land-based Testing of Cyeco™-BWMS（>32PSU）

Sampling date	High salinity (>32psu)	Sample number	Filter volume (L)	Condense volume (ml)	Dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.08.14	Influent water of the 4th test run	I-C4-SP1-B/b	1	100	Chrysophyta	*Isochrusis galbana*	1056.17	1213.19		
					Chlorophyta	*Platymanas helgolandica*	115.00			
					Diatom	*Chaetoceros spp.*	2.83			
						Skeletonema costatum	30.03			
						Paralia sulcata	3.50			
					others		5.67			
		I-C4-SP1-M/b	1	96	Chrysophyta	*Isochrusis galbana*	909.28	1112.00		
					Chlorophyta	*Platymanas helgolandica*	132.48			
					Diatom	*Sheletonema costatum*	47.84			
						Nitzschia closterum	0.96			
						Chaetoceros spp.	8.64			
						Paralia sulcata	5.44			
					others		7.36			
		I-C4-SP1-E/b	1	120	Chrysophyta	*Isochrusis galbana*	1064.20	1251.20		
					Chlorophyta	*Platymanas helgolandica*	150.20			
					Diatom	*Skeletonema costatum*	18.40			
						Nitzschia closterum	4.20			
						Chaetoceros spp.	9.20			
					others		5.00			
	Treated water of the 4th test run at intake	I-C4-SP2-B/b	10	115	Diatom	*Skeletonema costatum*	no alive cells	0.038	3.07	114.58
						Nitzschia sp.	no alive cells		0.13	
					Chrysophyta	*Isochrusis galbana*	0.019		99.19	
					Chlorophyta	*Platymanas helgolandica*	0.019		11.67	
					Others		no alive cells		0.25	
					Dinoflagellates	*Protoperidinium bipes*	no alive cells		0.13	
						Protoperidinium sp.	no alive cells		0.13	
		I-C4-SP2-M/b	10	100	Diatom	Paralia sulcata	no alive cells	0.017	6.77	103.04
						Skeletonema costatum	no alive cells		7.98	
					Chrysophyta	*Isochrusis galbana*	0.017		72.48	
					Chlorophyta	*Platymanas helgolandica*	no alive cells		8.47	
					Others		no alive cells		7.21	
					Dinoflagellates	*Prorocentrum micans*	no alive cells		0.13	

Analyst 李非 Proofreader 李晓东

Appendix 5. Results for organisms(10—50μm) of the Land-based Testing of Cyeco™-BWMS（>32PSU）

Sampling date	High salinity (>32psu)	Sample number	Filter volume (L)	Condense volume (ml)	Dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.08.14	Treated water of the 4th test run at intake	I-C4-SP2-E/b	10	96	Diatom	*Paralia sulcata*	no alive cells	0.016	15.78	127.94
						Skeletonema costatum	no alive cells		9.98	
					Chrysophyta	*Isochrusis galbana*	0.016		92.08	
					Chlorophyta	*Platymanas helgolandica*	no alive cells		7.89	
					Others		no alive cells		2.21	
2011.08.19	Effluent water in treated tank of the 4th test run at discharge	I-C4-SP3-B/b	10	80	Diatom	*Chaetoceros spp.*	no alive cells			
						Skeletonema costatum	no alive cells			
					Dinofllagelate		no alive cells			
					Chrysophyta	*Isochrusis galbana*	no alive cells			
					Chlorophyta	*Platymanas helgolandica*	no alive cells			
		I-C4-SP3-M/b	10	90	Diatom	*Skeletonema costatum*	no alive cells			
					Chrysophyta	*Isochrusis galbana*	no alive cells			
					Chlorophyta	*Platymanas helgolandica*	no alive cells			
		I-C4-SP3-E/b	10	92	Diatom	*Skeletonema costatum*	no alive cells			
						Chaetoceros spp.	no alive cells			
					Chrysophyta	*Isochrusis galbana*	no alive cells			
					Chlorophyta	*Platymanas helgolandica*	no alive cells			
2011.08.19	Effluent water in reference tank of the 4th test run at discharge	I-C4-SP4-B/b	10	90	Diatom	*Chaetoceros spp.*	1.62	137.47		
						Thalassiosira rotula	0.20			
						Skeletonema costatum	2.49			
						Pleurasigma spp.	0.02			
					Dinofllagelate	*Gyrodinium spp.*	0.02			
					Chrysophyta	*Isochrusis galbana*	125.48			
					Chlorophyta	*Platymanas helgolandica*	7.22			
					others		0.44			
		I-C4-SP4-M/b	10	80	Diatom	*Chaetoceros spp.*	0.36	106.93		
						Skeletonema costatum	0.61			
						Nitzschia longissima	0.03			
						Thalassiosira rotula	0.21			
						Gyrosigma spp.	0.05			
					Dinofllagelate	*Protoperidinium bipes*	0.19			
					Chrysophyta	*Isochrusis galbana*	98.36			
					Chlorophyta	*Platymanas helgolandica*	5.80			
					others		1.32			

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Appendix 5. Results for organisms(10—50μm) of the Land-based Testing of Cyeco™-BWMS（>32PSU）

Sampling date	High salinity (>32psu)	Sample number	Filter volume (L)	Condense volume (ml)	Dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.08.19	Effluent water in reference tank of the 4th test run at discharge	I-C4-SP4-E/b	10	80	Diatom	*Skeletonema costatum*	2.91	113.75		
						Chaetoceros spp.	1.08			
						Thalassiosira rotula	0.04			
						Nitzschia longissima	0.03			
					Dinofllagelate	*Protoperidinium bipes*	0.21			
					Chrysophyta	*Isochrusis galbana*	100.92			
					Chlorophyta	*Platymanas helgolandica*	7.92			
					others		0.65			
2011.08.20	Influent water of the 5th test run	I-C5-SP1-B/b	1	80	Diatom	*Skeletonema costatum*	107.73	1096.80		
						Chaetoceros spp.	7.47			
						Nitzschia longissima	0.13			
						Thalassiosira rotula	0.13			
					Dinofllagelate	*Protoperidinium bipes*	0.27			
					Chrysophyta	*Isochrusis galbana*	931.33			
					Chlorophyta	*Platymanas helgolandica*	46.93			
					others		2.80			
		I-C5-SP1-M/b	1	88	Diatom	*Skeletonema costatum*	72.16	1245.93		
						Chaetoceros spp.	7.04			
						Nitzschia longissima	0.88			
					Dinofllagelate	*Protoperidinium bipes*	2.05			
					Chrysophyta	*Isochrusis galbana*	1074.04			
					Chlorophyta	*Platymanas helgolandica*	69.52			
					others		20.24			
2011.08.20	Influent water of the 5th test run	I-C5-SP1-E/b	1	80	Diatom	*Skeletonema costatum*	78.40	1087.20		
						Thalassiosira rotula	1.60			
						Chaetoceros spp.	3.20			
						Nitzschia longissima	2.40			
						Paralia sulcata	5.07			
						Pleurasigma spp.	0.13			
					Dinofllagelate	*Protoperidinium bipes*	1.60			
					Chrysophyta	*Isochrusis galbana*	922.40			
					Chlorophyta	*Platymanas helgolandica*	61.60			
					others		10.80			

Analyst 李超 Proofreader 李瑞雪

Appendix 5. Results for organisms(10—50μm) of the Land-based Testing of Cyeco™-BWMS（>32PSU）

Sampling date	High salinity (>32psu)	Sample number	Filter volume (L)	Condense volume (ml)	Dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.08.20	Treated water of the 5th test run at intake	I-C5-SP2-B/b	10	80	Diatom	*Skeletonema costatum*	no alive cells	0. 013		104. 05
						Scrippsiella trochoidea	no alive cells			
						Thalassiosira rotula	no alive cells			
						Nitzschia longissima	no alive cells			
						Pleurasigma spp.	no alive cells			
					Dinofllagelate	*Protoperidinium bipes*	no alive cells		0.01	
						Heterocapsa trique	no alive cells		0.01	
						Protocentrum gracil	no alive cells		0.01	
					Chrysophyta	*Isochrusis galbana*	0. 013		94.75	
					Chlorophyta	*Platymanas helgolandica*	no alive cells		8.64	
					others		no alive cells		0.63	
2011.08.20	Treated water of the 5th test run at intake	I-C5-SP2-M/b	10	85	Diatom	*Skeletonema costatum*	no alive cells	0. 014	11.02	106.41
						Chaetoceros spp.	no alive cells		0.45	
						Nitzschia longissima	no alive cells		0.01	
						Thalassiosira rotula	no alive cells		0.03	
					Dinofllagelate	*Protoperidinium spp.*	no alive cells		0.04	
						prorocentrum triestium	no alive cells		0.01	
					Chrysophyta	*Isochrusis galbana*	0. 014		88.05	
					Chlorophyta	*Platymanas helgolandica*	no alive cells		5.78	
					others		no alive cells		1.01	
		I-C5-SP2-E/b	10	84	Diatom	*Skeletonema costatum*	no alive cells	no alive cells	15.01	89.68
						Chaetoceros spp.	no alive cells		0.18	
						Ditylum brightwelli	no alive cells		0.01	
						Thalassiosira rotula	no alive cells		0.03	
					Dinofllagelate	*Scrippsiella trochoidea*	no alive cells		0.03	
						Gyrosigma spp.	no alive cells		0.01	
						sp.	no alive cells		0.83	
					Chlorophyta	*Platymanas helgolandica*	no alive cells		6.61	
					Chrysophyta	*Isochrusis galbana*	no alive cells		66.96	
					Euglenophyta	*Eutreptiella gymustica*	no alive cells		0.01	
2011.08.25	Effluent water in treated tank of the 5th test run at	I-C5-SP3-B/b	10	88	Chrysophyta	*Isochrusis galbana*	no alive cells	no alive cells	57.74	67.57
					Chlorophyta	*Platymanas helgolandica*	no alive cells		6.17	
					Diatom	*Skeletonema costatum*	no alive cells		3.65	

Analyst _____ Proofreader _____

Appendix 5. Results for organisms(10—50μm) of the Land-based Testing of Cyeco™-BWMS（>32PSU）

Sampling date	High salinity (>32psu)	Sample number	Filter volume (L)	Condense volume (ml)	Dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.08.25	Effluent water in treated tank of the 5th test run at discharge	I-C5-SP3-M/b	10	96	Chrysophyta	*Isochrusis galbana*	no alive cells	no alive cell	65.79	76.75
					Chlorophyta	*Platymanas helgolandica*	no alive cells		6.00	
					Diatom	*Skeletonema costatum*	no alive cells		4.22	
					others		no alive cells		0.74	
		I-C5-SP3-E/b	10	92	Chrysophyta	*Isochrusis galbana*	no alive cells		61.66	69.37
					Chlorophyta	*Platymanas helgolandica*	no alive cells		6.98	
					Diatom	*Nitzschia sp.*	no alive cells		0.11	
					Dinoflagellates	*Protoperidinium bipes*	no alive cells		0.11	
						Protoperidinium pellucidium	no alive cells		0.29	
					others		no alive cells		0.23	
2011.08.25	Effluent water in reference tank of the 4th test run at discharge	I-C5-SP4-B/b	10	106	Chrysophyta	*Isochrusis galbana*	117.04	125.42		
					Chlorophyta	*Platymanas helgolandica*	8.23			
					others		0.14			
		I-C5-SP4-M/b	10	92	Chrysophyta	*Isochrusis galbana*	108.28	120.23		
					Chlorophyta	*Platymanas helgolandica*	9.97			
					Diatom	*Skeletonema costatum*	1.76			
					Dinofllagelate	*Peridinium spp.*	0.09			
					others	*others*	0.12			
		I-C5-SP4-E/b	10	92	Diatom	*Skeletonema costatum*	1.73	108.13		
						Nitzschia longissima	0.11			
					Dinofllagelate	*Peridinium bipes*	0.11			
						Protoperidium pelllucidium	0.21			
					Chrysophyta	*Isochrusis galbana*	97.75			
					Chlorophyta	*Platymanas helgolandica*	7.87			
					others		0.35			

Analyst 李娟 Proofreader 李端青

Appendix 6. Results for organisms（10—50μm） of the Land-based Testing of Cyeco™-BWMS（3-22PSU）

Sampling date	Test run	Sample number	Filter volume（L）	Condense volume（ml）	Dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					Phyta	species				
2011.08.21	Influent water of the 1st test run	II-C1-SP1-B/b	1	80	Diatoms	*Thalassiosira sp.*	3.20	1077.47		
						Chaetoceros sp.	0.13			
						Skeletonema costatum	52.27			
						Scrippsiella trochoidea	0.13			
					Chryphyta	*Isochrsis galbana*	918.80			
					Chlorophyta	*Platymonas helgolandica*	77.60			
					Dinofllagelate	*Gyrodinium spirale*	0.13			
					others	others	25.20			
		II-C1-SP1-M/b	1	80	Diatoms	*Chaetoceros sp.*	0.53	1162.93		
						Nizschia longissima	0.67			
						Skeletonema costatum	50.40			
						Scrippsiella trochoidea	0.27			
					Chlorophyta	*Platymonas helgolandica*	121.60			
					Chryphyta	*Isochrsis galbana*	958.40			
					Dinofllagelate	*Alexandrium sp.*	0.13			
						protoperidinium spp.	18.13			
					others	others	12.80			
		II-C1-SP1-E/b	1	84	Diatom	*Skeletonema costatum*	42.70	1049.72		
						Nizschia longissima	0.14			
					Dinofllagelate	*Gyrodinium spirale*	0.14			
						protoperidinium spp.	0.14			
					Chryphyta	*Isochrsis galbana*	888.16			
					Chlorophyta	*Platymonas helgolandica*	108.36			
					others	others	10.08			
2011.08.21	Treated water of the 1st test run at intake	II-C1-SP2-B/b	10	115	Diatom	*Skeletonema costatum*	no alive cells		16.33	140. 97
						Chaetoceros sp.			1.38	
						Nizschia longissima			0.40	
					Chryphyta	*Isochrsis galbana*			105.15	
					Chlorophyta	*Platymonas helgolandica*			16.56	
					others				1.15	

Analyst 李静 Proofreader 李瑞香

Appendix 6. Results for organisms（10—50μm） of the Land-based Testing of Cyeco™-BWMS（3-22PSU）

Sampling date	Low salinity (>3~22psu)	Sample number	Filter volume (L)	condense volume (ml)	dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.08.21	Treated water of the 1st test run at intake	II-C1-SP2-M/b	10	80	Diatom	*Skeletonema costatum*	no alive cells		7.63	110. 07
					Chryphyta	*Isochrsis galbana*			90.44	
					Chlorophyta	*Platymonas helgolandica*			10.56	
					others	others			1.44	
		II-C1-SP2-E/b	10	84	Diatom	*Skeletonema costatum*	no alive cells		7.56	109. 96
						Chaetoceros sp.			0.35	
						Licmophora abbreviata			0.01	
						Thalassiosira sp.			0.17	
						Amphiprora sp.			0.01	
					Chryphyta	*Isochrsis galbana*			91.18	
					Chlorophyta	*Platymonas helgolandica*			9.58	
					others	others			1.09	
2011.08.26	Effluent water in treated tank of the 1st test run at discharge	II-C1-SP3-B/b	10	76	Chryphyta	*Isochrsis galbana*	no alive cells		93.42	103.01
					Chlorophyta	*Platymonas helgolandica*			8.45	
					Diatom	*Skeletonema costatum*			0.68	
						Nizschia longissima			0.10	
					Dinofllagelate	*Peridinium spp.*			0.05	
					others	others			0.30	
		II-C1-SP3-M/b	10	84	Diatom	*Nizschia longissima*	no alive cells		0.11	90.86
					Chryphyta	*Isochrsis galbana*			83.93	
					Chlorophyta	*Platymonas helgolandica*			5.80	
					Dinofllagelate	*Peridinium spp.*			0.06	
					others	others			0.97	
		II-C1-SP3-E/b	10	88	Diatom	*Nizschia longissima*	no alive cells		0.50	106.45
					Chryphyta	*Isochrsis galbana*			93.69	
					Chlorophyta	*Platymonas helgolandica*			9.45	
					others	others			2.82	

Analyst _____ Proofreader _____

Appendix 6. Results for organisms（10—50μm） of the Land-based Testing of Cyeco^{TM}-BWMS（3-22PSU）

Sampling date	Low salinity (>3~22psu)	Sample number	Filter volume (L)	condense volume (ml)	dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.08.26	Effluent water in reference tank of the 1st test run at discharge	II-C1-SP4-B/b	10	100	Diatom	*Skeletonema costatum*	0.38	215.30		
						Nizschia longissima	1.45			
					Dinofllagelate	*Gyrodinium spirale*	0.25			
						Peridinium spp.	0.07			
						protoperidinium spp.	0.07			
					Chryphyta	*Isochrsis galbana*	203.95			
					Chlorophyta	*Platymonas helgolandica*	8.05			
					others	others	1.08			
		II-C1-SP4-M/b	10	96	Diatom	*Nizschia longissima*	1.39	220.66		
					Dinofllagelate	*Gyrodinium spirale*	0.18			
					Chryphyta	*Isochrsis galbana*	209.60			
					Chlorophyta	*Platymonas helgolandica*	7.73			
					others	others	1.76			
		II-C1-SP4-E/b	10	115	Diatom	*Nizschia longissima*	0.73	217.98		
						Skeletonema costatum	0.44			
					Dinofllagelate	*Gyrodinium spirale*	0.08			
					Chryphyta	*Isochrsis galbana*	209.40			
					Chlorophyta	*Platymonas helgolandica*	6.17			
					others	others	1.17			
2011.08.27	Influent water of the 2nd test run	II-C2-SP1-B/b	1	96	Diatom	*Skeletonema costatum*	490.56	1381.28		
						Nizschia longissima	2.40			
						Rhizosolenia delicatula	1.28			
					Chryphyta	*Isochrsis galbana*	729.92			
						Dictyocha fibula	7.36			
					Chlorophyta	*Platymonas helgolandica*	147.20			
						Gyrodinium spirale	1.28			
					Dinofllagelate	*Peridinium bipes*	1.28			
		II-C2-SP1-M/b	1	92	Chryphyta	*Isochrsis galbana*	460.00	1286.93		
						Dictyocha fibula	8.89			
					Chlorophyta	*Platymonas helgolandica*	134.01			
					Diatom	*Skeletonema costatum*	657.65			
						Nizschia longissima	8.89			
					Dinofllagelate	*Gyrodinium spirale*	1.53			
					others	others	15.95			

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Appendix 6. Results for organisms（10—50μm） of the Land-based Testing of Cyeco™-BWMS（3-22PSU）

Sampling date	Low salinity (>3~22psu)	Sample number	Filter volume (L)	condense volume (ml)	dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.08.27	Influent water of the 2nd test run	II-C2-SP1-E/b	1	89	Chryphyta	*Isochrsis galbana*	621.22	1525.61		
						Dictyocha fibula	6.68			
					Chlorophyta	*Platymonas helgolandica*	105.76			
					Diatom	*Skeletonema costatum*	774.45			
						Nizschia longissima	5.19			
					others	others	12.31			
2011.08.27	Treated water of the 2nd test run at intake	II-C2-SP2-B/b	10	101	Chryphyta	*Isochrsis galbana*	0.03	0.02	410.31	478.61
						Dictyocha fibula	no alive cells		5.03	
					Chlorophyta	*Platymonas helgolandica*	0. 02		15.87	
					Diatom	*Skeletonema costatum*	no alive cells		43.36	
						Nizschia longissima	no alive cells		1.36	
					Dinofllagelate	*Ceratium fursus*	no alive cells		0.17	
						Dinophysis acuminata	no alive cells		0.17	
					others	others	no alive cells		2.32	
		II-C2-SP2-M/b	10	98	Chryphyta	*Isochrsis galbana*	0. 02	0.02	370.96	471.64
						Dictyocha fibula	no alive cells		3.76	
					Chlorophyta	*Platymonas helgolandica*	no alive cells		13.52	
					Diatom	*Skeletonema costatum*	no alive cells		75.31	
					Dinofllagelate	*Gyrodinium spirale*	no alive cells		0.38	
					others	others	no alive cells		7.71	
		II-C2-SP2-E/b	10	102	Diatom	*Skeletonema costatum*	no alive cells	0.03	33.71	631.92
						Nizschia longissima	no alive cells		0.99	
						Licmophora abbreviata	no alive cells		0.17	
						Melosira sulcata	no alive cells		1.96	
					Chryphyta	*Isochrsis galbana*	2		557.18	
						Dictyocha fibula	no alive cells		8.99	
					Chlorophyta	*Platymonas helgolandica*	no alive cells		14.86	
					Dinofllagelate	*Dinophysis acuminata*	no alive cells		0.39	
					others	others	no alive cells		13.69	

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Appendix 6. Results for organisms（10—50μm） of the Land-based Testing of Cyeco™-BWMS（3-22PSU）

Sampling date	Low salinity (>3~22psu)	Sample number	Filter volume (L)	condense volume (ml)	dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.09.01	Effluent water in treated tank of the 2nd test run at discharge	II-C2-SP3-B/b	10	101	Chryphyta	*Isochrsis galbana*	no alive cells		87.53	110.86
					Chlorophyta	*Platymonas helgolandica*	no alive cells		6.30	
					others	others	no alive cells		1.28	
					Diatom	*Skeletonema costatum*	no alive cells		15.76	
		II-C2-SP3-M/b	10	100	Chryphyta	*Isochrsis galbana*	no alive cells		90.00	106.35
					Chlorophyta	*Platymonas helgolandica*	no alive cells		6.75	
					Diatom	*Skeletonema costatum*	no alive cells		9.60	
		II-C2-SP3-E/b	10	100	Chryphyta	*Isochrsis galbana*	no alive cells		72.17	94. 6
					Chlorophyta	*Platymonas helgolandica*	no alive cells		7.35	
					Diatom	*Skeletonema costatum*	no alive cells		12.12	
					others	others	no alive cells		2.97	
2011.09.01	Effluent water in reference tank of the 2nd test run at discharge	II-C2-SP4-B/b	10	100	Chryphyta	*Isochrsis galbana*	173.33	198.40	184. 89	
						Dictyocha fibula	0.93			
					Diatom	*Skeletonema costatum*	18.53			
					Chlorophyta	*Platymonas helgolandica*	5.47			
					Dinofllagelate	others	0.13			
		IIC2SP4M/b	10	100	Chryphyta	*Isochrsis galbana*	155.00	183.08		
					Chlorophyta	*Platymonas helgolandica*	4.67			
					Diatom	*Skeletonema costatum*	23.41			
		II-C2-SP4-E/b	10	100	Chryphyta	*Isochrsis galbana*	146.67	173.20		
					Diatom	*Skeletonema costatum*	21.60			
					Chlorophyta	*Platymonas helgolandica*				
2011.08.28	Influent water of the 3rd test run	II-C3-SP1-B/b	1	102	Chryphyta	*Isochrsis galbana*	1417.46	2041.02		
						Dictyocha fibula	3.91			
					Diatom	*Skeletonema costatum*	408.51			
						Nizschia longissima	5.95			
						Chaetoceros sp.	11.73			
						Pleurosigma spp.	1.87			
						Melosira sulcata	15.64			
					Chlorophyta	*Platymonas helgolandica*	136.85			
					others	others	39.10			

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Appendix 6. Results for organisms（10—50μm） of the Land-based Testing of Cyeco™-BWMS（3-22PSU）

Sampling date	Low salinity (>3~22psu)	Sample number	Filter volume (L)	condense volume (ml)	dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.08.28	Influent water of the 3rd test run	II-C3-SP1-M/b	1	104	Chryphyta	*Isochrsis galbana*	903.41	1638.87		
						Dictyocha fibula	3.99			
					Diatom	*Skeletonema costatum*	514.28			
						Nizschia longissima	1.91			
					Chlorophyta	*Platymonas helgolandica*	135.55			
					others	others	79.73			
		II-C3-SP1-E/b	1	100	Chryphyta	*Isochrsis galbana*	945.00	1514.67		
						Dictyocha fibula	3.83			
					Diatom	*Skeletonema costatum*	412.67			
						Nizschia longissima	1.83			
						Pleurosigma spp.	1.83			
					Chlorophyta	*Platymonas helgolandica*	111.17			
					others	others	38.33			
2011.08.28	Treated water of the 3rd test run at intake	II-C3-SP2-B/b	10	115	Chryphyta	*Isochrsis galbana*	0.06	0.08	247.98	316.08
						Dictyocha fibula	no alive cells		1.76	
					Chlorophyta	*Platymonas helgolandica*	0.02		15.87	
					Diatom	*Skeletonema costatum*	no alive cells		37.91	
						Nizschia longissima	no alive cells		1.76	
					others	others	no alive cells		10.79	
		II-C3-SP2-M/b	10	110	Chryphyta	*Isochrsis galbana*	0. 02	0.04	168.67	228.73
						Dictyocha fibula	no alive cells		0.64	
					Chlorophyta	*Platymonas helgolandica*	no alive cells		18.13	
					Diatom	*Skeletonema costatum*	no alive cells		30.78	
						Nizschia longissima	no alive cells		0.62	
						Thalassiosira sp.	no alive cells		0.20	
						Chaetoceros sp.	no alive cells		0.64	
					Dinofllagelate	*Ceratium fursus*	no alive cells		0.20	
						Prorocentrium sp.	no alive cells		0.20	
					others	others	0. 02		8.64	

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Appendix 6. Results for organisms（10—50μm） of the Land-based Testing of Cyeco™-BWMS（3-22PSU）

Sampling date	Low salinity (>3~22psu)	Sample number	Filter volume (L)	condense volume (ml)	dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.08.28	Treated water of the 3rd test run at intake	II-C3-SP2-E/b	10	102	Chryphyta	*Isochrsis galbana*	0. 03	0.03	234.60	281.91
						Dictyocha fibula	no alive cells		1.96	
					Chlorophyta	*Platymonas helgolandica*	no alive cells		7.04	
					Diatom	*Skeletonema costatum*	no alive cells		28.36	
						Melosira sulcata	no alive cells		3.13	
						Nizschia longissima	no alive cells		0.19	
					others	others	no alive cells		6.65	
2011.09.02	Effluent water in treated tank of the 3rd test run at discharge	IIC3SP3B/b	10	100	Chryphyta	*Isochrsis galbana*	no alive cells	no alive cells	58.83	66.17
					Diatom	*Skeletonema costatum*	no alive cells		3.33	
						Diatom sp.	no alive cells		3.47	
					Chlorophyta	*Platymonas helgolandica*	no alive cells		0.53	
		II-C3-SP3-M/b	10	100	Chryphyta	*Isochrsis galbana*	no alive cells		88.83	95.90
					Diatom	*Skeletonema costatum*	no alive cells		3.33	
						Diatom sp.	no alive cells		1.60	
					Chlorophyta	*Platymonas helgolandica*	no alive cells		2.13	
		II-C3-SP3-E/b	10	100	Chryphyta	*Isochrsis galbana*	no alive cells		68.33	74.60
						Dictyocha fibula	no alive cells		0.13	
					Diatom	*Skeletonema costatum*	no alive cells		2.53	
						Diatom sp.	no alive cells		1.33	
					Chlorophyta	*Platymonas helgolandica*	no alive cells		2.27	
2011.09.02	Effluent water in reference tank of the 3rd test run at discharge	II-C3-SP4-B/b	10	100	Chryphyta	*Isochrsis galbana*	66.67	216.47		
						Dictyocha fibula	0.67			
					Diatom	*Skeletonema costatum*	34.40			
						Diatom sp.	108.33			
					Chlorophyta	*Platymonas helgolandica*	6.40			
		II-C3-SP4-M/b	10	100	Chryphyta	*Isochrsis galbana*	53.33	169.60		
						Dictyocha fibula	0.13			
					Chlorophyta	*Platymonas helgolandica*	3.73			
					Diatom	*Diatom sp.*	100.00			
						Skeletonema costatum	12.27			
					Dinofllagelate	*Gymnodinium sp.*	0.13			

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Appendix 6. Results for organisms（10—50μm） of the Land-based Testing of Cyeco™-BWMS（3-22PSU）

Sampling date	Low salinity (>3~22psu)	Sample number	Filter volume (L)	condense volume (ml)	dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.09.02	Effluent water in reference tank of the 3rd test run at discharge	II-C3-SP4-E/b	10	100	Chryphyta	*Isochrsis galbana*	31.67	177.13		
						Dictyocha fibula	0.80			
					Chlorophyta	*Platymonas helgolandica*	4.13			
					Diatom	*Diatom sp.*	120.00			
						Skeletonema costatum	20.53			
2011.09.03	Influent water of the 4th test run	II-C4-SP1-B/b	1	90	Chryphyta	*Isochrsis galbana*	530.00	1130.4		
						Dictyocha fibula	1.20			
					Chlorophyta	*Platymonas helgolandica*	283.60			
					Diatom	*Diatom sp.*	254.40			
						Skeletonema costatum	61.20			
		II-C4-SP1-M/b	1	90	Chryphyta	*Isochrsis galbana*	615.00	1094.3		
					Dinofllagelate	*prorocentrum* sp.	4.80			
					Chlorophyta	*Platymonas helgolandica*	288.00			
					Diatom	*Diatom sp.*	128.90			
						Skeletonema costatum	57.60			
		II-C4-SP1-E/b		90	Chlorophyta	*Platymonas helgolandica*	244.80	996.2		
					Chryphyta	*Isochrsis galbana*	555.00			
					Diatom	*Diatom sp.*	118.40			
						Skeletonema costatum	73.80			
						Coscinodiscus sp.	4.20			
2011.09.03	Treated water of the 4th test run at intake	II-C4-SP2-B/b	10	90	Chlorophyta	*Platymonas helgolandica*	0.02	0. 04	34.54	110.64
					Chryphyta	*Isochrsis galbana*	0.02		21.76	
						Dictyocha fibula	no alive cells		0.84	
					Diatom	Diatoms	no alive cells		50.50	
						Skeletonema costatum	no alive cells		3.00	
		II-C4-SP2-M/b	10	90	Chlorophyta	*Platymonas helgolandica*	0.02	0. 04	58.50	151.86
					Chryphyta	*Isochrsis galbana*	0.02		34.50	
						Dictyocha fibula	no alive cells		1.44	
					Diatom	*Diatom sp.*	no alive cells		52.50	
						Skeletonema costatum	no alive cells		4.92	

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Appendix 6. Results for organisms（10—50μm） of the Land-based Testing of Cyeco™-BWMS（3-22PSU）

Sampling date	Low salinity (>3~22psu)	Sample number	Filter volume (L)	condense volume (ml)	dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.09.03	Treated water of the 4th test run at intake	II-C4-SP2-E/b	10	90	Chlorophyta	*Platymonas helgolandica*	0.02	0. 02	49.50	133.98
					Chryphyta	*Isochrsis galbana*	no alive cells		27.00	
						Dictyocha fibula	no alive cells		0.60	
					Diatom	*Diatom sp.*	no alive cells		46.50	
						Skeletonema costatum	no alive cells		10.38	
2011.09.08	Effluent water in treated tank of the 4th test run at discharge	II-C4-SP3-B/b	10	102	Chryphyta	*Isochrsis galbana*	no alive cells	no alive cells	104.04	107.96
					Chlorophyta	*Platymonas helgolandica*	no alive cells		3.92	
		II-C4-SP3-M/b	10	106	Chryphyta	*Isochrsis galbana*	no alive cells		84.88	90.48
					Chlorophyta	*Platymonas helgolandica*	no alive cells		5.09	
					Diatom	*Nitzschia sp.*	no alive cells		0.51	
		II-C4-SP3-E/b	10	110	Chryphyta	*Isochrsis galbana*	no alive cells		88.44	93.46
					Chlorophyta	*Platymonas helgolandica*	no alive cells		5.02	
2011.09.08	Effluent water in reference tank of the 4th test run at discharge	II-C4-SP4-B/b	10	110	Chryphyta	*Isochrsis galbana*	143.00	148.544		
					Chlorophyta	*Platymonas helgolandica*	5.54			
		II-C4-SP4-M/b	10	105	Chryphyta	*Isochrsis galbana*	155.40	164.24		
					Chlorophyta	*Platymonas helgolandica*	7.81			
					others	others	1.03			
		II-C4-SP4-E/b	10	115	Chryphyta	*Isochrsis galbana*	156.40	166.43		
					Chlorophyta	*Platymonas helgolandica*	7.18			
					others	others	2.85			
2011.09.04	Influent water of the 5th test run	II-C5-SP1-B/b	1	80	Chlorophyta	*Platymonas helgolandica*	279.47	1040.00		
					Chryphyta	*Isochrsis galbana*	640.00			
						Dictyocha fibula	2.13			
					Diatom	*Diatom sp.*	56.53			
						Skeletonema costatum	61.87			
		II-C5-SP1-M/b	1	80	Chlorophyta	*Platymonas helgolandica*	397.87	1081.60		
					Chryphyta	*Isochrsis galbana*	600.00			
					Diatom	*Diatom sp.*	56.53			
						Skeletonema costatum	27.20			
		II-C5-SP1-E/b	1	80	Chlorophyta	*Platymonas helgolandica*	338.49	1002.49		
					Chryphyta	*Isochrsis galbana*	560.00			
					Diatom	*Diatom sp.*	48.00			
						Skeletonema costatum	56.00			

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Appendix 6. Results for organisms（10—50μm） of the Land-based Testing of Cyeco™-BWMS（3-22PSU）

Sampling date	Low salinity (>3~22psu)	Sample number	Filter volume (L)	condense volume (ml)	dominant Species		Alived density (cell/ml)	Total alived density(cell/ml)	Dead density (cell/ml)	Total dead density(cell/ml)
					phyta	species				
2011.09.04	Treated water of the 5th test run at intake	II-C5-SP2-B/b	10	80	Chlorophyta	*Platymonas helgolandica*	0.01	0.01	96.85	226.4
					diatom	*Diatom sp.*	no alive cells		18.88	
					Chryphyta	*Isochrsis galbana*	no alive cells		110.67	
		II-C5-SP2-M/b	10	80	Chlorophyta	*Platymonas helgolandica*	no alive cells	no alive cells	48.00	178.67
					diatom	*Diatom sp.*	no alive cells		36.00	
					Chryphyta	*Isochrsis galbana*	no alive cells		94.67	
		II-C5-SP2-E/b	10	80	Chlorophyta	*Platymonas helgolandica*	no alive cells	no alive cells	42.67	138.67
					diatom	*Diatom sp.*	no alive cells		17.33	
					Chryphyta	*Isochrsis galbana*	no alive cells		78.67	
2011.09.09	Effluent water in treated tank of the 5th test run at discharge	II-C5-SP3-B/b	10	108	Chryphyta	*Isochrsis galbana*	no alive cells	no alive cells	125.28	132.54
					Chlorophyta	*Platymonas helgolandica*	no alive cells		5.70	
					Diatom	*Nitzschia sp.*	no alive cells		0.86	
					others	others	no alive cells		0.69	
		II-C5-SP3-M/b	10	120	Chryphyta	*Isochrsis galbana*	no alive cells		151.20	158.83
					Chlorophyta	*Platymonas helgolandica*	no alive cells		4.61	
					Diatom	*Nitzschia sp.*	no alive cells		0.72	
					others	others	no alive cells		2.30	
		II-C5-SP3-E/b	10	106	Chryphyta	*Isochrsis galbana*	no alive cells		101.76	108.63
					Chlorophyta	*Platymonas helgolandica*	no alive cells		5.60	
					Diatom	*Nitzschia sp.*	no alive cells		0.68	
					others	others	no alive cells		0.59	
2011.09.09	Effluent water in treated tank of the 5th test run at discharge	II-C5-SP4-B/b	10	106	Chryphyta	*Isochrsis galbana*	133.56	147.68		
					Chlorophyta	*Platymonas helgolandica*	5.60			
					Diatom	*Nitzschia sp.*	7.63			
					others	others	0.89			
		II-C5-SP4-M/b	10	120	Chryphyta	*Isochrsis galbana*	136.80	163.87		
					Chlorophyta	*Platymonas helgolandica*	4.61			
					Diatom	*Nitzschia sp.*	20.16			
					others	others	2.30			
		II-C5-SP4-E/b	10	100	Chryphyta	*Isochrsis galbana*	146.50	165.7		
					Chlorophyta	*Platymonas helgolandica*	6.40			
					Diatom	*Nitzschia sp.*	11.52			
					others	others	1.28			

Analyst 李超 Proofreader 李瑞青

Appendix 7. Results for microbes of the Land-based Testing of Cyeco ™-BWMS (>32PSU)

Sampling date	Test run	Type of tank	Sample number	Intestinal Enterococci (cfu/100mL)	*Escherichia coli* (cfu/100mL)	*Vibrio* spp. (cfu/100mL)	Bacteria (cfu/100mL)
2011.7.30	Influent water of the 1st test run at intake	control	I-C_1-SP_1-B/C	3.2×10^2	4.2×10^2	2.6×10^3	5.4×10^6
			I-C_1-SP_1-M/C	4.5×10^2	3.9×10^2	2.4×10^3	4.3×10^6
			I-C_1-SP_1-E/C	5.2×10^2	6.6×10^2	3.4×10^3	5.8×10^6
		treatment	I-C_1-SP_2-B/C	0	0	0	0
			I-C_1-SP_2-M/C	0	0	0	0
			I-C_1-SP_2-E/C	0	0	0	0
2011.08.04	Effluent water of the 1st test run at discharge	control	I-C_1-SP_4-B/C	6.0×10^1	2.4×10^2	8.3×10^3	3.9×10^6
			I-C_1-SP_4-M/C	7.0×10^1	2.6×10^2	7.8×10^3	4.3×10^6
			I-C_1-SP_4-E/C	9.0×10^1	2.2×10^2	6.5×10^3	3.2×10^6
		treatment	I-C_1-SP_3-B/C	0	0	0	0
			I-C_1-SP_3-M/C	0	0	0	0
			I-C_1-SP_3-E/C	0	0	0	0
2011.07.31	Influent water of the 2nd test run at intake	control	I-C_2-SP_1-B/C	1.1×10^2	3.8×10^2	4.5×10^3	3.5×10^6
			I-C_2-SP_1-M/C	1.7×10^2	2.7×10^2	5.2×10^3	2.3×10^6
			I-C_2-SP_1-E/C	1.8×10^2	2.3×10^2	8.3×10^3	2.4×10^6
		treatment	I-C_2-SP_2-B/C	0	0	0	0
			I-C_2-SP_2-M/C	0	0	0	0
			I-C_2-SP_2-E/C	0	0	0	0
2011.08.05	Effluent water of the 2nd test run at discharge	control	I-C_2-SP_4-B/C	2.2×10^2	4.5×10^2	6.2×10^3	5.9×10^5
			I-C_2-SP_4-M/C	1.2×10^2	3.8×10^2	5.8×10^3	4.6×10^5
			I-C_2-SP_4-E/C	1.6×10^2	5.3×10^2	4.4×10^3	4.9×10^5
		treatment	I-C_2-SP_3-B/C	0	0	0	0
			I-C_2-SP_3-M/C	0	0	0	0
			I-C_2-SP_3-E/C	0	0	0	0

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Appendix 7. Results for microbes of the Land-based Testing of Cyeco ™-BWMS (>32PSU)

Sampling date	Test run	Type of tank	Sample number	Intestinal Enterococci (cfu/100mL)	*Escherichia coli* (cfu/100mL)	*Vibrio* (cfu/100mL	Bacteria (cfu/100mL)
2011.08.13	Influent water of the 3rd test run at intake	control	I-C_3-SP_1-B/C	1.8×10^2	3.5×10^2	7.5×10^3	5.3×10^6
			I-C_3-SP_1-M/C	1.4×10^2	2.8×10^2	8.4×10^3	4.6×10^6
			I-C_3-SP_1-E/C	1.7×10^2	4.2×10^2	9.2×10^3	4.2×10^6
		treatment	I-C_3-SP_2-B/C	0	0	0	8.0×10^2
			I-C_3-SP_2-M/C	0	0	0	5.1×10^2
			I-C_3-SP_2-E/C	0	0	0	1.1×10^3
2011.08.18	Effluent water of the 3rd test run at discharge	control	I-C_3-SP_4-B/C	1.9×10^2	5.7×10^2	7.8×10^3	4.2×10^5
			I-C_3-SP_4-M/C	1.5×10^2	4.5×10^2	6.9×10^3	4.8×10^5
			I-C_3-SP_4-E/C	1.3×10^2	5.2×10^2	6.4×10^3	6.5×10^5
		treatment	I-C_3-SP_3-B/C	0	0	0	5.1×10^2
			I-C_3-SP_3-M/C	0	0	0	5.4×10^2
			I-C_3-SP_3-E/C	0	0	0	1.1×10^2
2011/8/14	Influent water of the 4th test run at intake	control	I-C_4-SP_1-B/C	0.6×10^2	4.5×10^2	5.8×10^4	2.8×10^6
			I-C_4-SP_1-M/C	0.9×10^2	3.2×10^2	4.9×10^4	2.4×10^6
			I-C_4-SP_1-E/C	1.1×10^2	3.6×10^2	6.3×10^4	3.7×10^6
		treatment	I-C_4-SP_2-B/C	0	0	0	5.3×10^2
			I-C_4-SP_2-M/C	0	0	0	4.8×10^2
			I-C_4-SP_2-E/C	0	0	0	6.7×10^2
2011.08.19	Effluent water of the 4th test run at discharge	control	I-C_4-SP_4-B/C	1.1×10^2	3.5×10^2	3.4×10^3	4.8×10^5
			I-C_4-SP_4-M/C	0.9×10^2	4.7×10^2	5.8×10^3	5.4×10^5
			I-C_4-SP_4-E/C	1.5×10^2	5.6×10^2	4.3×10^3	5.9×10^5
		treatment	I-C_4-SP_3-B/C	0	0	0	4.3×10^2
			I-C_4-SP_3-M/C	0	0	0	4.8×10^2
			I-C_4-SP_3-E/C	0	0	0	3.5×10^2

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Appendix 7. Results for microbes of the Land-based Testing of Cyeco ™-BWMS (>32PSU)

Sampling date	Test run	Type of tank	Sample number	Intestinal Enterococci (cfu/100mL)	*Escherichia coli* (cfu/100mL)	*Vibrio* (cfu/100mL	Bacteria (cfu/100mL)
2011.08.20	Influent water of the 5th test run at intake	control	I-C_5-SP_1-B/C	2.2×10^2	3.4×10^2	4.4×10^3	2.4×10^6
			I-C_5-SP_1-M/C	2.9×10^2	4.2×10^2	5.4×10^3	2.1×10^6
			I-C_5-SP_1-E/C	1.8×10^2	3.8×10^2	7.3×10^3	1.4×10^6
		treatment	I-C_5-SP_2-B/C	0	40	0	3.5×10^2
			I-C_5-SP_2-M/C	0	50	0	2.2×10^2
			I-C_5-SP_2-E/C	0	80	0	1.2×10^2
2011.08.25	Effluent water of the 5th test run at discharge	control	I-C_5-SP_4-B/C	7.4×10^2	1.5×10^2	2.5×10^3	1.7×10^5
			I-C_5-SP_4-M/C	4.5×10^2	1.4×10^2	3.5×10^3	2.6×10^5
			I-C_5-SP_4-E/C	6.0×10^2	1.2×10^2	2.2×10^3	1.6×10^5
		treatment	I-C_5-SP_3-B/C	0	0	0	3.0×10^2
			I-C_5-SP_3-M/C	0	0	0	2.6×10^2
			I-C_5-SP_3-E/C	0	0	0	2.6×10^2

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Appendix 8. Results for microbes of the Land-based Testing of Cyeco™-BWMS（3~32PSU）

Sampling date	Test run	Type of tank	Sample number	Intestinal Enterococci (cfu/100mL)	*Escherichia coli* (cfu/100mL)	*Vibrio* spp. (cfu/100mL)	Bacteria (cfu/100mL)
2011.08.21	Influent water of the 1st test run at intake	control	II-C_1-SP_1-B/C	5.4×10^3	8.4×10^2	4.8×10^4	1.8×10^6
			II-C_1-SP_1-M/C	4.4×10^3	6.8×10^2	5.2×10^4	2.7×10^6
			II-C_1-SP_1-E/C	3.4×10^3	5.3×10^2	4.4×10^4	2.6×10^6
		treatment	II-C_1-SP_2-B/C	0	0	0	2.2×10^2
			II-C_1-SP_2-M/C	0	0	0	3.5×10^2
			II-C_1-SP_2-E/C	0	0	0	2.6×10^2
2011.08.26	Effluent water of the 1st test run at discharge	control	II-C_1-SP_4-B/C	8.9×10^2	2.5×10^2	1.8×10^4	4.3×10^5
			II-C_1-SP_4-M/C	7.2×10^2	2.2×10^2	1.3×10^4	4.7×10^5
			II-C_1-SP_4-E/C	9.6×10^2	2.5×10^2	1.5×10^4	5.8×10^5
		treatment	II-C_1-SP_3-B/C	0	0	0	4.2×10^2
			II-C_1-SP_3-M/C	0	0	0	2.8×10^2
			II-C_1-SP_3-E/C	0	0	0	2.6×10^2
2011.08.27	Influent water of the 2nd test run at intake	control	II-C_2-SP_1-B/C	4.4×10^3	4.5×10^2	8.4×10^4	1.3×10^6
			II-C_2-SP_1-M/C	3.7×10^3	5.1×10^2	6.6×10^4	1.1×10^6
			II-C_2-SP_1-E/C	4.1×10^3	4.9×10^2	7.2×10^4	1.6×10^6
		treatment	II-C_2-SP_2-B/C	0	1.2×10^2	0	2.9×10^2
			II-C_2-SP_2-M/C	0	1.1×10^2	0	3.5×10^2
			II-C_2-SP_2-E/C	0	1.0×10^2	0	5.2×10^2
2011.09.01	Effluent water of the 2nd test run at discharge	control	II-C_2-SP_4-B/C	4.6×10^3	1.6×10^3	7.1×10^4	1.3×10^6
			II-C_2-SP_4-M/C	4.3×10^3	1.2×10^3	6.5×10^4	2.1×10^6
			II-C_2-SP_4-E/C	3.1×10^3	2.2×10^3	6.8×10^4	1.8×10^6
		treatment	II-C_2-SP_3-B/C	0	0	0	5.2×10^2
			II-C_2-SP_3-M/C	0	0	0	1.3×10^2
			II-C_2-SP_3-E/C	0	0	0	3.0×10^2

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Appendix 8. Results for microbes of the Land-based Testing of Cyeco™-BWMS（3~32PSU）

Sampling date	Test run	Type of tank	Sample number	Intestinal Enterococci (cfu/100mL)	*Escherichia coli* (cfu/100mL)	*Vibrio* (cfu/100mL)	Bacteria (cfu/100mL)
2011.08.28	Influent water of the 3rd test run at intake	control	II-C_3-SP_1-B/C	2.9×10^3	5.1×10^2	8.1×10^4	1.7×10^6
			II-C_3-SP_1-M/C	3.4×10^3	4.5×10^2	7.8×10^4	1.2×10^6
			II-C_3-SP_1-E/C	3.6×10^3	5.5×10^2	7.7×10^4	1.5×10^6
		treatment	II-C_3-SP_2-B/C	0	0.7×10^2	0	5.3×10^2
			II-C_3-SP_2-M/C	0	1.0×10^2	0	5.1×10^2
			II-C_3-SP_2-E/C	0	0.9×10^2	0	1.5×10^2
2011.09.02	Effluent water of the 3rd test run at discharge	control	II-C_3-SP_4-B/C	2.6×10^3	9.6×10^3	2.9×10^5	1.5×10^6
			II-C_3-SP_4-M/C	4.2×10^3	7.2×10^3	2.1×10^5	2.5×10^6
			II-C_3-SP_4-E/C	3.5×10^3	8.3×10^3	2.3×10^5	2.0×10^6
		treatment	II-C_3-SP_3-B/C	0	0	0	0
			II-C_3-SP_3-M/C	0	0	0	0
			II-C_3-SP_3-E/C	0	0	0	0
2011.09.03	Influent water of the 4th test run at intake	control	II-C_4-SP_1-B/C	5.3×10^3	6.6×10^3	2.6×10^5	5.5×10^6
			II-C_4-SP_1-M/C	4.5×10^3	8.1×10^3	2.8×10^5	6.0×10^6
			II-C_4-SP_1-E/C	5.7×10^3	7.5×10^3	2.2×10^5	6.5×10^6
		treatment	II-C_4-SP_2-B/C	0	1.1×10^2	0	0
			II-C_4-SP_2-M/C	0	1.0×10^2	0	0
			II-C_4-SP_2-E/C	0	0.5×10^2	0	0
2011.09.08	Effluent water of the 4th test run at discharge	control	II-C_4-SP_4-B/C	6.8×10^3	2.1×10^4	6.6×10^4	4.5×10^5
			II-C_4-SP_4-M/C	5.7×10^3	2.2×10^4	1.1×10^5	5.3×10^5
			II-C_4-SP_4-E/C	6.2×10^3	2.4×10^4	8.3×10^4	5.8×10^5
		treatment	II-C_4-SP_3-B/C	0	0	0	0
			II-C_4-SP_3-M/C	0	0	0	0
			II-C_4-SP_3-E/C	0	0	0	0

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Appendix 8. Results for microbes of the Land-based Testing of Cyeco™-BWMS（3~32PSU）

Sampling date	Test run	Type of tank	Sample number	Intestinal Enterococci (cfu/100mL)	*Escherichia coli* (cfu/100mL)	*Vibrio* (cfu/100mL)	Bacteria (cfu/100mL)
2011.09.04	Influent water of the 5th test run at intake	control	II-C_5-SP_1-B/C	3.2×10^3	7.6×10^3	3.3×10^5	5.8×10^6
			II-C_5-SP_1-M/C	4.3×10^3	6.7×10^3	3.1×10^5	6.2×10^6
			II-C_5-SP_1-E/C	3.7×10^3	8.4×10^3	3.8×10^5	6.5×10^6
		treatment	II-C_5-SP_2-B/C	0	0	0	0
			II-C_5-SP_2-M/C	0	0	0	0
			II-C_5-SP_2-E/C	0	0	0	0
2011.09.09	Effluent water of the 5th test run at discharge	control	II-C_5-SP_4-B/C	1.4×10^3	2.2×10^4	1.8×10^5	3.0×10^6
			II-C_5-SP_4-M/C	2.2×10^3	1.6×10^4	1.5×10^5	2.8×10^6
			II-C_5-SP_4-E/C	1.7×10^3	2.5×10^4	2.3×10^5	3.5×10^6
		treatment	II-C_5-SP_3-B/C	0	0	0	0
			II-C_5-SP_3-M/C	0	0	0	0
			II-C_5-SP_3-E/C	0	0	0	0

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Appendix 9. Results for the total residual oxide (TRO) of the Land-based Testing of Cyeco™-BWMS

Sampling date	Discharge of high salinity	Test run	Type of tank	Sample number	TRO density（ueq/L）		equate to density of Cl_2mg/L（as Cl_2）	
						Average		Average
2011.08.18	Discharge of high salinity	3rd test run	control	Ⅰ-C3-SP4-B/d	1.491	1.784	0.106	0.127
				Ⅰ-C3-SP4-M/d	2.105		0.149	
				Ⅰ-C3-SP4-E/d	1.754		0.125	
			treatment	Ⅰ-C3-SP3-B/d	1.834	1.752	0.130	0.124
				Ⅰ-C3-SP3-M/d	1.632		0.116	
				Ⅰ-C3-SP3-E/d	1.789		0.127	
2011.09.01	Discharge of low salinity	2nd test run	control	II-C2-SP4-B/d	3.158	3.129	0.224	0.222
				II-C2-SP4-M/d	3.158		0.224	
				II-C2-SP4-E/d	3.070		0.218	
			treatment	II-C2-SP3-B/d	3.081	3.072	0.219	0.218
				II-C2-SP3-M/d	2.951		0.210	
				II-C2-SP3-E/d	3.183		0.226	
Note：The total residual oxidant concentration in seawater, equivalenting concentration (μeq./L)or concentration of chlorine (mg/L as Cl2).								

Analyst 谢湘雲 Proofreader 孙霞

Appendix10 Results for chlorophyll-a of the Land-based Testing of Cyeco™-BWMS

Sampling date	Test run	Type of tank	Sample number	Concentration of Chla (mg/m³)	Average of Chla (mg/m3)
2011.07.30	Influent water of the 1st test run at intake	control	I-C1-SP1-B/E	6.26	5.79
			I-C1-SP1-M/e	5.54	
			I-C1-SP1-E/e	5.56	
		treatment	I-C1-SP2-B/e	3.67	3.99
			I-C1-SP2-M/e	4.14	
			I-C1-SP2-E/e	4.14	
2011.08.04	Effluent water of the 1st test run at discharge	treatment	I-C1-SP3-B/e	0.13	0.11
			I-C1-SP3-M/e	0.09	
			I-C1-SP3-E/e	0.11	
		control	I-C1-SP4-B/e	0.25	0.21
			I-C1-SP4-M/e	0.14	
			I-C1-SP4-E/e	0.23	
2011.07.31	Influent water of the 2nd test run at intake	control	I-C2-SP1-B/e	4.98	5.07
			I-C2-SP1-M/e	4.91	
			I-C2-SP1-E/e	5.32	
		treatment	I-C2-SP2-B/e	2.77	3.22
			I-C2-SP2-M/e	2.64	
			I-C2-SP2-E/e	4.26	
2011.08.05	Effluent water of the 2nd test run at discharge	treatment	I-C2-SP3-B/e	0.18	0.16
			I-C2-SP3-M/e	0.14	
			I-C2-SP3-E/e	sample lossed	
		control	I-C2-SP4-B/e	0.87	0.84
			I-C2-SP4-M/e	0.82	
			I-C2-SP4-E/e	0.83	

Analyst 孙萍 Proofreader 李晓青

Appendix10 Results for chlorophyll-a of the Land-based Testing of Cyeco™-BWMS

Sampling date	High salinity (〉32PSU)	Type of tank	Sample number	Concentration of Chla (mg/m³)	Average of Chla (mg/m3)
2011.08.13	Influent water of the 3rd test run at intake	control	I-C3-SP1-B/e	5.58	5.31
			I-C3-SP1-M/e	5.35	
			I-C3-SP1-E/e	4.99	
		treatment	I-C3-SP2-B/e	4.63	4.85
			I-C3-SP2-M/e	4.40	
			I-C3-SP2-E/e	5.52	
2011.08.18	Effluent water of the 3rd test run at discharge	treatment	I-C3-SP3-B/e	0.16	0.15
			I-C3-SP3-M/e	0.18	
			I-C3-SP3-E/e	0.12	
		control	I-C3-SP4-B/e	0.55	0.47
			I-C3-SP4-M/e	0.47	
			I-C3-SP4-E/e	0.39	
2011.08.14	Influent water of the 4th test run at intake	control	I-C4-SP1-B/e	4.79	4.90
			I-C4-SP1-M/e	4.81	
			I-C4-SP1-E/e	5.11	
		treatment	I-C4-SP2-B/e	4.46	4.23
			I-C4-SP2-M/e	4.10	
			I-C4-SP2-E/e	4.11	
2011.08.19	Effluent water of the 4th test run at discharge	treatment	I-C4-SP3-B/e	0.13	0.13
			I-C4-SP3-M/e	0.12	
			I-C4-SP3-E/e	0.14	
		control	I-C4-SP4-B/e	0.35	0.37
			I-C4-SP4-M/e	0.38	
			I-C4-SP4-E/e	0.39	

Analyst 孙萍 Proofreader 李瑞青

Appendix10 Results for chlorophyll-a of the Land-based Testing of Cyeco™-BWMS

Sampling date	High salinity (〉32PSU)	Type of tank	Sample number	Concentration of Chla (mg/m³)	Average of Chla (mg/m3)
2011.08.20	Influent water of the 5th test run at intake	control	I-C5-SP1-B/e	4.02	4.58
			I-C5-SP1-M/e	4.78	
			I-C5-SP1-E/e	4.93	
		treatment	I-C5-SP2-B/e	3.56	3.47
			I-C5-SP2-M/e	3.85	
			I-C5-SP2-E/e	3.02	
2011.08.25	Effluent water of the 5th test run at discharge	treatment	I-C5-SP3-B/e	0.07	0.07
			I-C5-SP3-M/e	0.08	
			I-C5-SP3-E/e	0.06	
		control	I-C5-SP4-B/e	0.25	0.21
			I-C5-SP4-M/e	0.18	
			I-C5-SP4-E/e	0.20	
Sampling date	Low salinity (3-22PSU)	Type of tank	Sample number	Concentration of Chla (mg/m³)	Average of Chla (mg/m3)
2011.08.21	Influent water of the 1st test run at intake	control	II-C1-SP1-B/e	6.16	5.72
			II-C1-SP1-M/e	5.90	
			II-C1-SP1-E/e	5.10	
		treatment	II-C1-SP2-B/e	3.94	4.51
			II-C1-SP2-M/e	4.61	
			II-C1-SP2-E/e	4.98	
2011.08.26	Effluent water of the 1st test run at discharge	treatment	II-C1-SP3-B/e	0.10	0.14
			II-C1-SP3-M/e	0.18	
			II-C1-SP3-E/e	0.14	
		control	II-C1-SP4-B/e	0.20	0.19
			II-C1-SP4-M/e	0.19	
			II-C1-SP4-E/e	0.18	

Analyst 孙萍 Proofreader 李强

Appendix10 Results for chlorophyll-a of the Land-based Testing of Cyeco™-BWMS

Sampling date	Low salinity (3-22PSU)	Type of tank	Sample number	Concentration of Chla (mg/m³)	Average of Chla (mg/m3)
2011.08.27	Influent water of the 2nd test run at intake	control	II-C2-SP1-B/e	11.18	11.28
			II-C2-SP1-M/e	11.93	
			II-C2-SP1-E/e	10.73	
		treatment	II-C2-SP2-B/e	7.77	7.72
			II-C2-SP2-M/e	7.96	
			II-C2-SP2-E/e	7.43	
2011.09.01	Effluent water of the 2nd test run at discharge	treatment	II-C2-SP3-B/e	0.35	0.34
			II-C2-SP3-M/e	0.34	
			II-C2-SP3-E/e	0.32	
		control	II-C2-SP4-B/e	2.61	2.51
			II-C2-SP4-M/e	2.42	
			II-C2-SP4-E/e	2.50	
2011.08.28	Influent water of the 3rd test run at intake	control	II-C3-SP1-B/e	10.27	9.83
			II-C3-SP1-M/e	9.25	
			II-C3-SP1-E/e	9.97	
		treatment	II-C3-SP2-B/e	8.10	6.94
			II-C3-SP2-M/e	6.58	
			II-C3-SP2-E/e	6.13	
2011.09.02	Effluent water of the 3rd test run at discharge	treatment	II-C3-SP3-B/e	0.33	0.31
			II-C3-SP3-M/e	0.31	
			II-C3-SP3-E/e	0.28	
		control	II-C3-SP4-B/e	3.33	2.31
			II-C3-SP4-M/e	1.70	
			II-C3-SP4-E/e	1.91	

Analyst 孙萍 Proofreader 李炳春

Appendix10 Results for chlorophyll-a of the Land-based Testing of Cyeco™-BWMS

Sampling date	Low sanility (3-22PSU)	Type of tank	Sample number	Concentration of Chla (mg/m³)	Average of Chla (mg/m3)
2011.09.03	Influent water of the 4th test run at intake	control	II-C4-SP1-B/e	5.42	5.69
			II-C4-SP1-M/e	5.70	
			II-C4-SP1-E/e	5.96	
		treatment	II-C4-SP2-B/e	5.53	5.45
			II-C4-SP2-M/e	5.84	
			II-C4-SP2-E/e	4.97	
2011.09.08	Effluent water of the 4th test run at discharge	treatment	II-C4-SP3-B/e	0.15	0.19
			II-C4-SP3-M/e	0.25	
			II-C4-SP3-E/e	0.19	
		control	II-C4-SP4-B/e	0.46	0.46
			II-C4-SP4-M/e	0.41	
			II-C4-SP4-E/e	0.50	
2011.09.04	Influent water of the 5th test run at intake	control	II-C5-SP1-B/e	8.89	9.70
			II-C5-SP1-M/e	10.86	
			II-C5-SP1-E/e	9.35	
		treatment	II-C5-SP2-B/e	10.04	9.42
			II-C5-SP2-M/e	9.70	
			II-C5-SP2-E/e	8.51	
2011.09.09	Effluent water of the 5th test run at discharge	treatment	II-C5-SP3-B/e	0.12	0.15
			II-C5-SP3-M/e	0.18	
			II-C5-SP3-E/e	0.15	
		control	II-C5-SP4-B/e	0.53	0.48
			II-C5-SP4-M/e	0.43	
			II-C5-SP4-E/e	0.48	

Analyst 孙萍 Proofreader 李晓雷

Appendix11 Results for Photosynthetic activity of phytoplankton（Fv/Fm）of the Land-based Testing of Cyeco™-BWMS

Sampling date	Test run	Tank	Sample number	Fv/Fm	Average Fv/Fm
2011.07.30	Influent water of the 1st test run	Control	Ⅰ-C1-SP1-B/E	0.43	0.44
			Ⅰ-C1-SP1-M/e	0.44	
			Ⅰ-C1-SP1-E/e	0.45	
		Treatment	Ⅰ-C1-SP2-B/e	0.11	0.12
			Ⅰ-C1-SP2-M/e	0.10	
			Ⅰ-C1-SP2-E/e	0.16	
2011.08.04	Effluent water of the 1st test run	Treatment	Ⅰ-C1-SP3-B/e	0.03	0.03
			Ⅰ-C1-SP3-M/e	0.04	
			Ⅰ-C1-SP3-E/e	0.02	
		Control	Ⅰ-C1-SP4-B/e	0.15	0.15
			Ⅰ-C1-SP4-M/e	0.14	
			Ⅰ-C1-SP4-E/e	0.17	
2011.07.31	Influent water of the 2nd test run	Control	Ⅰ-C2-SP1-B/e	0.47	0.48
			Ⅰ-C2-SP1-M/e	0.47	
			Ⅰ-C2-SP1-E/e	0.51	
		Treatment	Ⅰ-C2-SP2-B/e	0.08	0.07
			Ⅰ-C2-SP2-M/e	0.04	
			Ⅰ-C2-SP2-E/e	0.08	
2011.08.05	Effluent water of the 2nd test run	Treatment	Ⅰ-C2-SP3-B/e	0.03	0.02
			Ⅰ-C2-SP3-M/e	0.02	
			Ⅰ-C2-SP3-E/e	0.02	
		Control	Ⅰ-C2-SP4-B/e	0.27	0.30
			Ⅰ-C2-SP4-M/e	0.32	
			Ⅰ-C2-SP4-E/e	0.30	

Analyst 孙萍 proofreader 李炳青

Appendix 12. Chlorophyll-based Results of MPN cultivation of the Land-based Testing of Cyeco™-BWMS (High salinity)

Sample number	2011.8.25	2011.8.26	2011.8.27	2011.8.28	2011.8.29	2011.8.30	2011.8.31	2011.9.1	2011.9.2	2011.9.3	2011.9.4	2011.9.5	2011.9.6	201.9.7
I-C5-SP4-B/e1	0.80	1.30	4.20	12.50	23.10	36.70	45.90	54.70	71.00	90.10	94.50	105.60	107.20	100.80
I-C5-SP4-B/e2	0.80	1.20	4.50	12.90	23.10	37.10	43.90	59.70	72.70	94.30	93.80	117.10	113.40	105.10
I-C5-SP4-M/e1	0.80	1.40	4.30	11.80	21.50	34.80	42.30	55.50	77.40	94.10	82.00	58.80	21.10	12.00
I-C5-SP4-M/e2	0.80	1.10	4.50	13.00	22.40	34.30	50.10	59.00	78.10	93.20	89.00	85.90	33.90	21.60
I-C5-SP4-E/e1	0.80	1.30	4.20	12.60	21.10	36.10	46.30	61.90	73.10	95.40	97.30	100.80	105.00	100.60
I-C5-SP4-E/e2	0.80	1.30	4.30	11.80	22.70	35.00	42.50	58.70	89.80	97.00	97.90	99.00	99.50	97.70
I-C5-SP3-B/e1-1	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.20
I-C5-SP3-B/e1-2	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.40	1.60	5.90
I-C5-SP3-B/e2-1	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.30	0.40	4.60	7.60
I-C5-SP3-B/e2-2	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
I-C5-SP3-B/e3-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	11.20	24.50
I-C5-SP3-B/e3-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-C5-SP3-M/e1-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-C5-SP3-M/e1-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
I-C5-SP3-M/e2-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	4.30
I-C5-SP3-M/e2-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-C5-SP3-M/e3-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	1.30
I-C5-SP3-M/e3-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-C5-SP3-E/e1-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.20	1.60
I-C5-SP3-E/e1-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-C5-SP3-E/e2-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.30	1.40	8.10
I-C5-SP3-E/e2-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	1.40
I-C5-SP3-E/e3-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-C5-SP3-E/e3-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.80	2.50	3.10	8.80	11.60

Analyst 孙萍 Proofreader

Appendix 13. Chlorophyll-based Results of MPN cultivation of the Land-based Testing of Cyeco™-BWMS (Low salinity)

Sample number	2011.9.2	2011.9.3	2011.9.4	2011.9.5	2011.9.6	2011.9.7	2011.9.8	2011.9.9	2011.9.10	2011.9.11	2011.9.12	2011.9.13	2011.9.14	2011.9.14
II-C3-SP4-B/e1	0.8	1.2	4.4	12.8	21.9	40.5	50.2	64.7	91	96.2	102.6	104.5	103.4	144
II-C3-SP4-B/e2	0.8	1.3	4.7	14.1	23.7	40.3	53.5	65.2	93.6	100.2	108.4	111.3	120.1	170.1
II-C3-SP4-M/e1	0.8	1.5	4.9	14.1	23.1	39.6	48.8	52.8	94.5	91.7	101.9	117.3	112.3	163.5
II-C3-SP4-M/e2	0.8	1.4	4.7	14.9	25.3	42.1	57.4	64.3	92.3	96	100.9	111.8	108.9	155.5
II-C3-SP4-E/e1	0.8	1.4	4.7	14.1	23.6	41.6	57.3	62.3	91.1	109	114.2	110.7	121.2	124.3
II-C3-SP4-E/e2	0.8	1.5	5.1	16.2	25.3	42.4	54.9	64	92.5	99.2	102.3	112	122.3	144.3
II-C3-SP3-B/e1-1	0.1	0.1	0	0	0	0	0	0.2	0.1	0.7	0.4	1.5	4.6	26.3
II-C3-SP3-B/e1-2	0.1	0.1	0	0	0	0	0	0.1	0.1	0.4	0.5	2.4	7.2	26.2
II-C3-SP3-B/e2-1	0.2	0.2	0	0	0	0	0	0.3	0	0.1	0.2	0.7	2.5	12.8
II-C3-SP3-B/e2-2	0.2	0.2	0	0	0	0	0	0.2	0.3	2.4	8.7	17.5	20.7	19.1
II-C3-SP3-B/e3-1	0.1	0	0	0	0	0	0	0.1	0.2	0.8	3.9	18	20.9	25.8
II-C3-SP3-B/e3-2	0.1	0	0	0	0	0	0	0.1	0.2	0.8	2.1	3.9	8.5	13.8
II-C3-SP3-M/e1-1	0.1	0	0	0	0	0	0	0	0	0.2	0.4	1.2	3.2	19
II-C3-SP3-M/e1-2	0.1	0	0	0	0	0	0	0	0.2	0.4	0.8	1.8	2.9	10
II-C3-SP3-M/e2-1	0	0	0	0	0	0	0	0	0	0.1	0.2	0.5	1.3	8.5
II-C3-SP3-M/e2-2	0	0	0	0	0	0	0	0	0.6	2.3	3.7	7.8	9.4	13.8
II-C3-SP3-M/e3-1	0.1	0	0	0	0	0	0	0.1	0.1	0.3	0.5	1.5	1.1	1.7
II-C3-SP3-M/e3-2	0.1	0	0	0	0	0	0	0.1	0.1	0.1	0.2	0.5	0.8	3.9
II-C3-SP3-E/e1-1	0.2	0	0	0	0	0	0	0.1	0	0.1	0.2	0.7	2.4	6.9
II-C3-SP3-E/e1-2	0.2	0	0	0	0	0	0	0.1	0.1	0.3	0.4	2	6.8	21.7
II-C3-SP3-E/e2-1	0.2	0	0	0	0	0	0	0	0.2	1.3	4.7	18.2	24.5	34
II-C3-SP3-E/e2-2	0.2	0	0	0	0	0	0	0	0.1	0.2	0.4	1.4	3.7	13
II-C3-SP3-E/e3-1	0	0	0	0	0	0	0	0	0.1	0.2	0.3	0.7	0.9	2.1
II-C3-SP3-E/e3-2	0	0	0	0	0	0	0	0	0.1	0.1	0.2	0.1	0.2	1.3

Analyst 孙萍 Proofreader